Instruction Manual

Program Controller X

Type : PVX

Fuji Electric Systems Co., Ltd.

INP–TN1PVXd-E

PREFACE

We thank you for purchasing Fuji Program Controller X (Type: PVX).

This instruction manual explains the installation, wiring, operation and maintenance of the Program Controller X, so please read through it before using the controller.

■ Safety Precautions

Before use, carefully read the safety precautions for correct operation.

- The precautions concern important matters related to safety. Be sure to observe them. The safety matters are ranked to "DANGER," "CAUTION."

Indications and meanings are as follows.

DANGER	If the handling is wrong, dangerous situations might occur, causing death or serious injury.
CAUTION	If the handling is wrong, dangerous situations might occur, causing medium or slight degree of injury or physical damage only.

DANGER

- If the fault or anomaly of the device may cause serious accident or troubles to other devices, externally install appropriate protective circuit to avoid accidents.
- The instrument has no power switch nor fuse. Install them if necessary. (Fuse rating 250 V, 1 A).
- For avoiding device breakage and fault, supply a power voltage matching the rating.
- For avoiding electric shock, malfunction and device troubles, do not turn on power until all installation and wiring have ended.
- The instrument is not an intrinsically-safe explosion-proof type. Do not use it in atmosphere of combustible or explosive gases.
- Never disassemble, retouch, remodel nor repair the instrument. Otherwise, abnormal operation, electric shock or fire may occur.
- While turned on, do not touch the terminals. Otherwise, electric shock or malfunction may occur.
- Before engaging or disengaging the module or unit, turn off power. Otherwise, electric shock, malfunction or troubles may occur.
- Periodic maintenance is recommended so that the instrument can be used continuously and safely. Some parts installed on the device have limited service life or are subjected to secular change.
- Do not block the ventilation opening located on the top and bottom of the main unit. Otherwise, fault, abnormal operation, shortened service life or fire may occur.

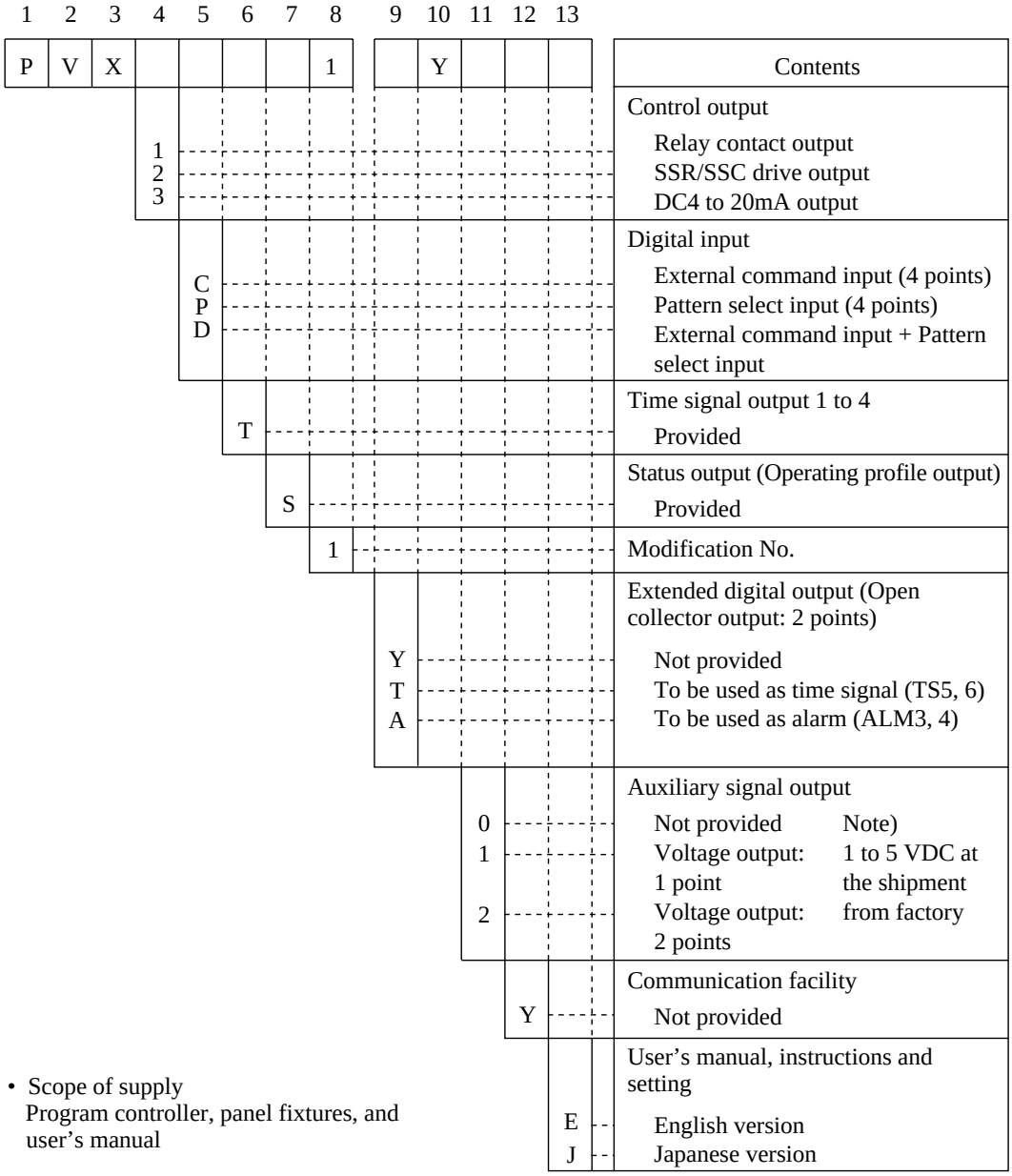
1. Handling precaution	
⚠ CAUTION	Read the item “5. Installation and wiring” in this instruction manual and follow the instructions. (1) Do not use the controller in a place with high temperature, high humidity, dust, corrosive gas, vibration, shock, etc., to prevent electric shocks, fire or malfunction. (2) Note that improper installation will cause drop-off, trouble, or malfunction. (3) Keep the unit from foreign objects such as power cables chips to prevent fire accident, trouble malfunction.

2. Wiring precaution	
⚠ CAUTION	Read the item “5. Installation and wiring” in this instruction manual and follow the instructions. (1) The unit must be earthed. If not earthed, it causes electric shocks or malfunction. (2) Be sure to connect the rated power source. Connection of different rating of power source may lead to a risk of fire accident. (3) Wiring work must be performed by qualified engineers. Incorrect wiring may lead to electric shocks, malfunction or trouble.

3. Operation precaution	
⚠ CAUTION	Do not touch the terminals when power is ON to avoid electric shocks or malfunction.

4. Parameters	
⚠ CAUTION	(1) Read the items “2. Programming”, “3. Setting up” and “4. Advanced Usage” in this instruction manual and follow the instructions. (2) Use each parameter within the limit of operation noted in this instruction manual.

■ Code Symbols


1 2 3 4 5 6 7 8 9 10 11 12 13
P V X 1 Y
Contents
Control output
1 Relay contact output
2 SSR/SSC drive output
3 DC4 to 20mA output
Digital input
C External command input (4 points)
P Pattern select input (4 points)
D External command input + Pattern select input
Time signal output 1 to 4
T Provided
Status output (Operating profile output)
S Provided
1 Modification No.
Extended digital output (Open collector output: 2 points)
Y Not provided
T To be used as time signal (TS5, 6)
A To be used as alarm (ALM3, 4)
Auxiliary signal output
0 Not provided
1 Voltage output: 1 point
2 Voltage output: 2 points
Note) 1 to 5 VDC at the shipment from factory
Communication facility
Y Not provided
User's manual, instructions and setting
E English version
J Japanese version

• Scope of supply
Program controller, panel fixtures, and user's manual

■ List of Abbreviations frequently used in this Manual:

CLR: Clear
DSP: Display
PTN: Pattern
SEL: Select
ENT: Enter
HLD: Hold
SFT: Shift
REST: Reset
ALM: Alarm
MAN: Manual
PTN: Pattern
PV: Processing Variable
DV: Deviation
SV: Set Value
TM: Time
MV: Manipulating Value
A/M: Auto/Manual

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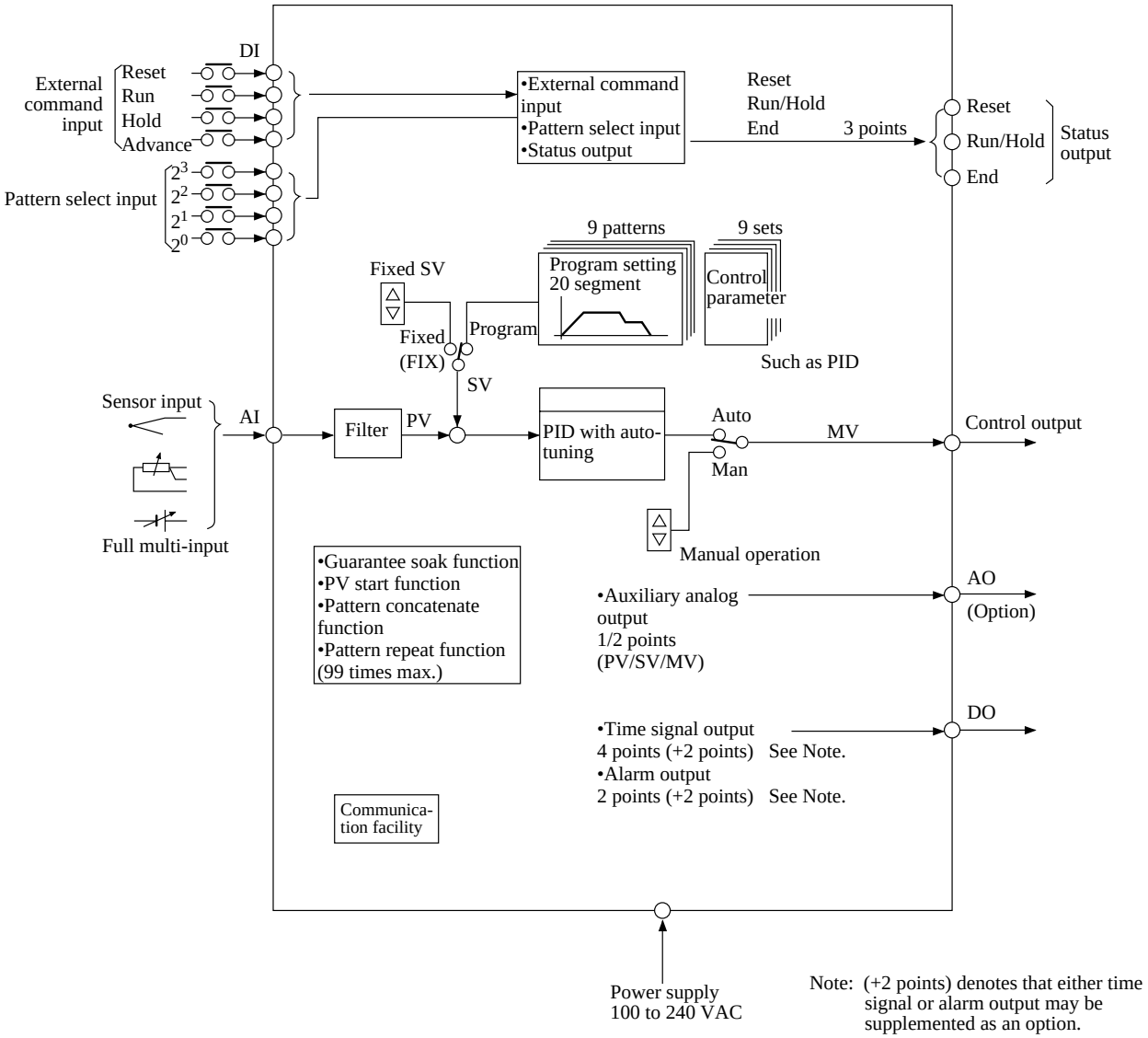
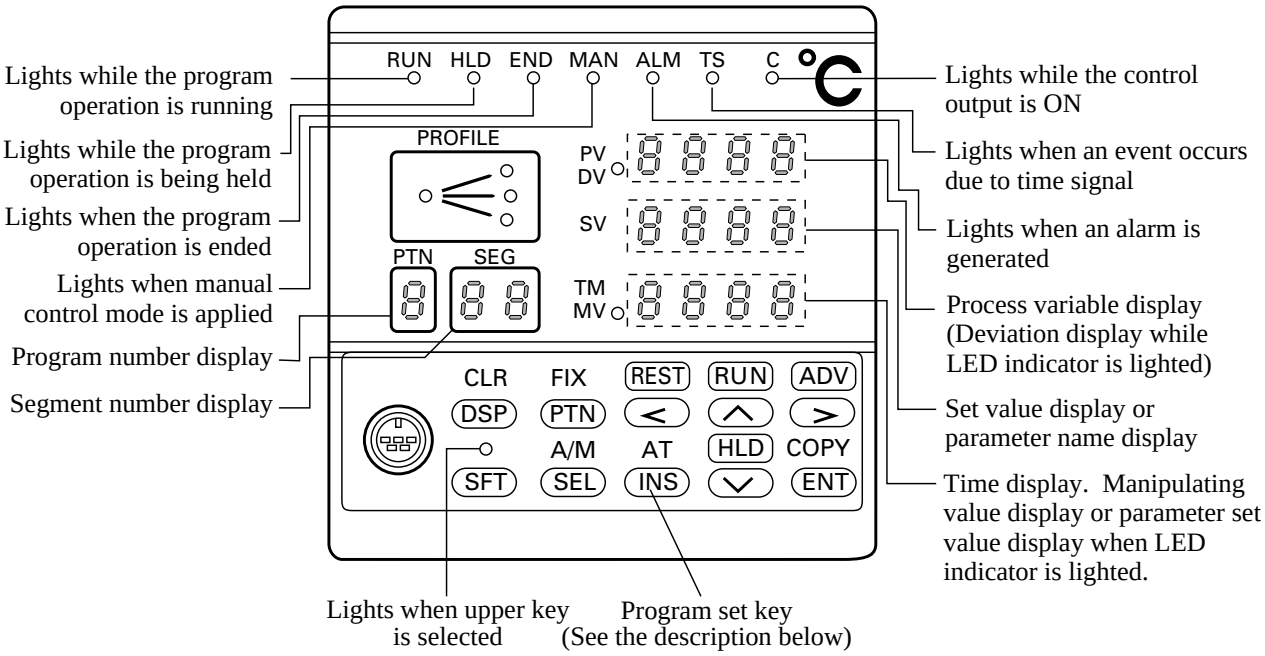
■ Overview

This Program Controller, 96 mm × 96 mm in the front-view size, incorporates a microprocessor to perform the programmed control for Processing variables, such as temperature, humidity, pressure, flow rate, rotating speed. Also, transmission with the use of T-link configuration.



Note: (+2 points) denotes that either time signal or alarm output may be supplemented as an option.

■ Explanation of Front Panel


Lights while the program operation is running
Lights while the program operation is being held
Lights when the program operation is ended
Lights when manual control mode is applied
Program number display
Segment number display
RUN HLD END MAN ALM TS C
PROFILE
PV
DV
SV
PTN SEG
TM
MV
CLR FIX REST RUN ADV
DSP PTN
A/M AT HLD COPY
SFT SEL INS ENT
Lights while the control output is ON
Lights when an event occurs due to time signal
Lights when an alarm is generated
Process variable display (Deviation display while LED indicator is lighted)
Set value display or parameter name display
Time display. Manipulating value display or parameter set value display when LED indicator is lighted.
Lights when upper key is selected
Program set key (See the description below)

■ Explanation of Keys and How to Use Them

Keys are provided in two lines: the upper line and lower line.
To use a function in the lower line, depress an appropriate key as it is.
To use a function in the upper line, depress (SFT) key once and a key to be used.

CLR
(DSP) : To be used for changing the display.

FIX
(PTN) : To be used for selecting a program pattern.

A/M
(SEL) : To be used for selecting a parameter.

AT
(INS) : To be used for inserting a program pattern.

END
(ENT) : To be used for data setting and entry.

(RUN) (HLD)
(∧) (∨) : ↑ ↓ Cursor keys to be used for selecting a parameter and for changing a data value.
(REST) (ADV)
(<) (>) : ← → Cursor keys to be used for selecting a parameter and for selecting a column.

(SFT) : To be depressed when a key function in the upper line is used. When this key is depressed, the LED embedded in this key will light by toggle action, thus indicating that a key in the upper line has been selected.
By depressing the key once again, the LED will go off, indicating that a key function in the lower line has been selected.

CLR
(SFT) → (DSP) : To be used for erasing a program pattern.

FIX
(SFT) → (PTN) : To be used when entering the fixed-value operating mode.

A/M
(SFT) → (SEL) : To be used when switching from AUTO to MANUAL, or vice versa. The AUTO mode and the MANUAL mode are alternately changed over by depressing the key with a toggle mechanism.

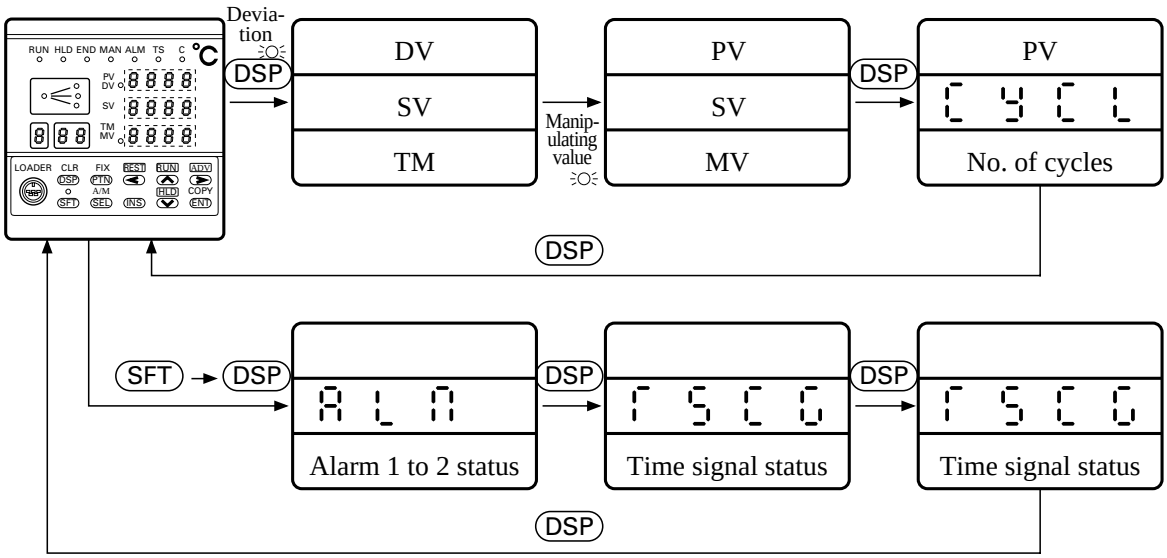
AT
(SFT) → (INS) : To be used when starting the auto tuning.

COPY
(SFT) → (ENT) : To be used when copying a program pattern.

SECTION 1 BEFORE STARTING OPERATION

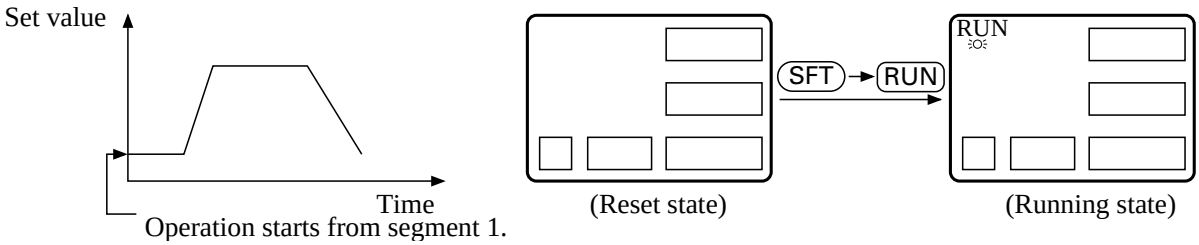
1. Changing Displays on Operating Screen

Various operation displays can be changed by depressing (DSP) key.

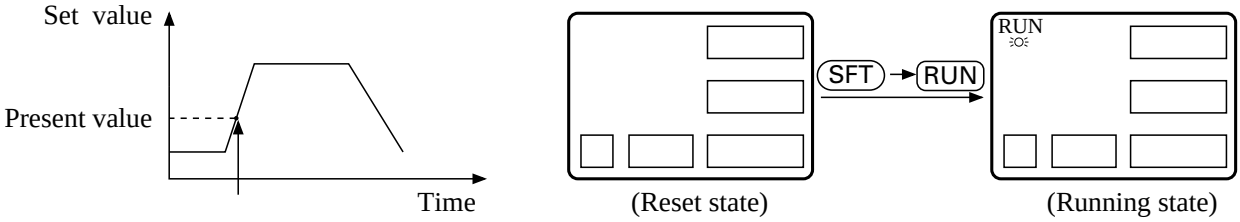


2. Operation

(1) Starting the operation



(2) Starting the operation at the current temperature (PV start function)

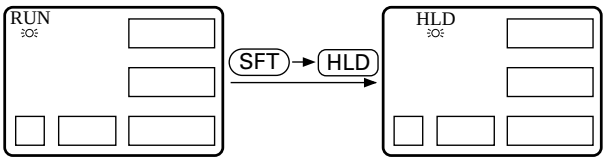


This operation is performed only when YES has been assigned to PV Start (PVST) in the program pattern mode.

If NO is assigned in the setting, the normal operation (1) is performed.

(3) Suspending the operation

This is an instance when the program running operation is temporarily held while operating the unit.

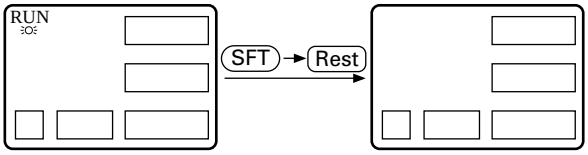


(Running state) (Holding state)

To resume the program running operation, follow the step for (1) Starting the operation.

(4) Ending the operation

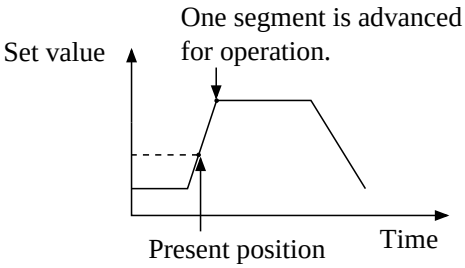
Resetting is performed in the running state or in the holding state.

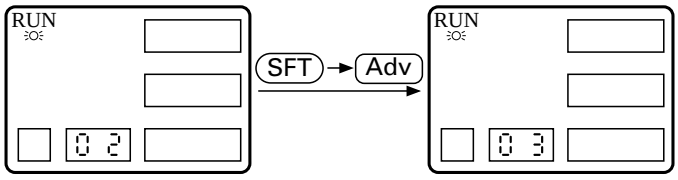


(Running or Holding state) (Reset state)

(5) Advancing a segment while in the running operation

A next segment is forcedly advanced while in the running operation.

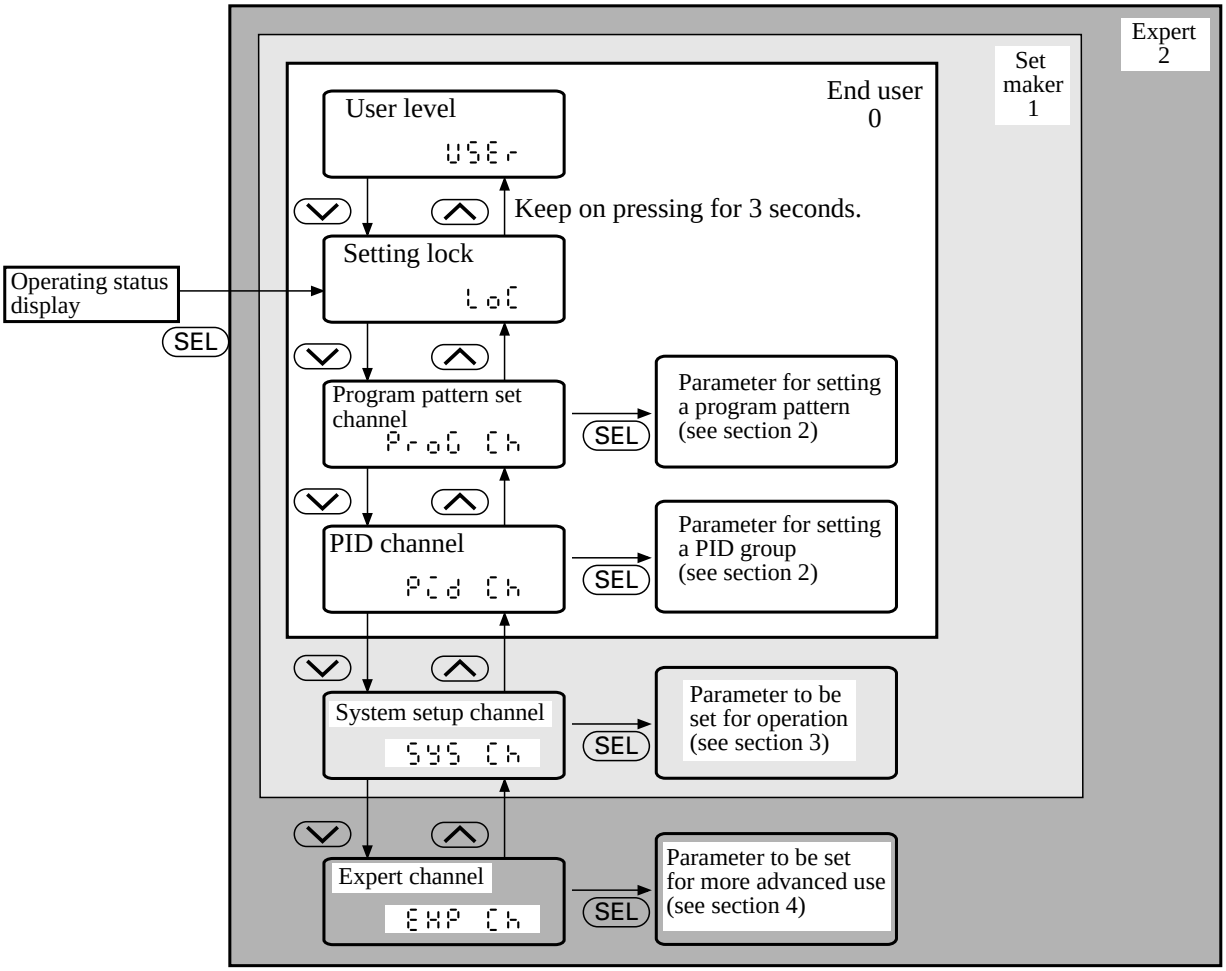




(Running state) (Running state)

3. Parameter Setting Overview

The unit parameter structure and parameter calling methods are shown below.



For details of paramters in each channel, see the Parameter List at the end of this Manual.

User level USEr

Parameter display range may be changed by setting the user level.

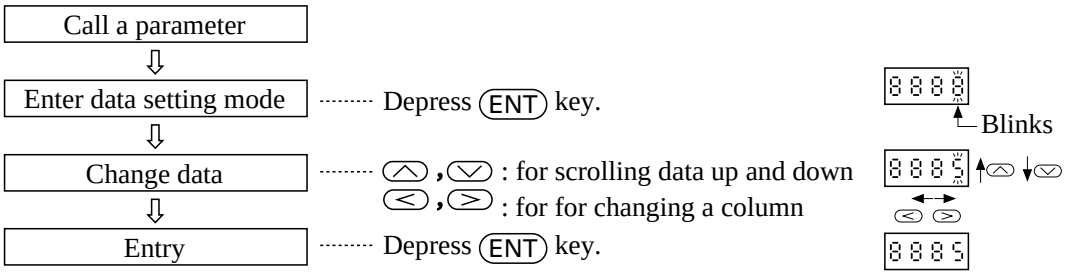
0: End user	Displays parameters in the unshadowed area ▭. The displayed parameters are needed for program pattern setting.
1: Set maker	Displays parameters in the unshadowed area ▭ plus dark-shadowed area ▭. The displayed parameters are needed for setting up the unit.
2: Expert	Displays parameters in the light-shadowed area ▭ in addition to the unshadowed ▭ and dark-shadowed areas ▭. The displayed parameters are needed for more advanced use of this unit.

Setting lock LoC

This is a setting lock parameter for prevention of an erroneous setting.

0: Total release	Enables the setting of all parameters, with no setting locked.
1: Operation release	With the setting locked, no change can be made for parameter values. Permits only the running operation and reset operation.
2: Total lock	All the setting operations are locked. Inhibits a change in parameter value and the running operation. (However, parameter call and display are allowed)

Data change and registration procedures



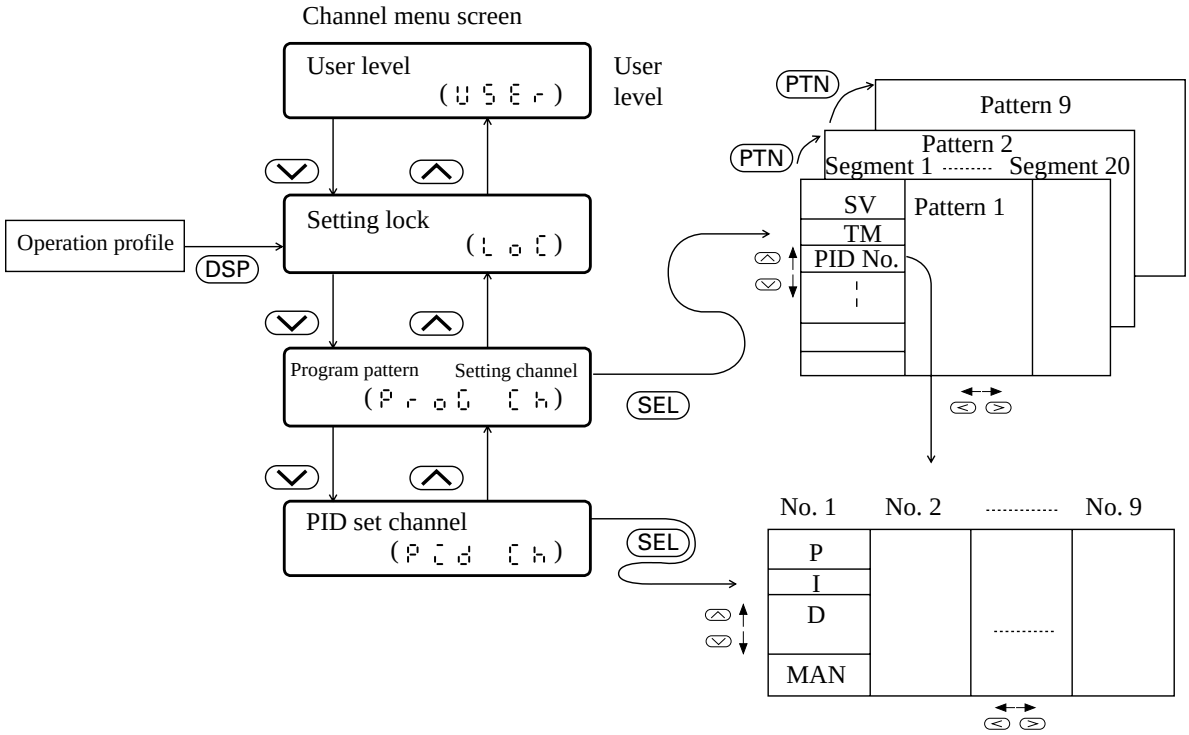
SECTION 2 PROGRAMMING

Programmers are requested to read this section carefully.

1. Parameter Structure and Parameter Calling Method

With this unit, nine 20-segment program patterns can be registered. Control parameters, such as PID to be used in each segment, can be specified out of nine PID groups as illustrated below.

A program pattern is set with the program pattern setting channel, while a PID group is set with the PID setting channel.



Key operation on the channel menu screen

(∧) (∨) : Moves up and down in the channel menu.

(SEL) : Selects a channel on display.

Key operation on the program pattern setting channel

(∧) (∨) : Various parameters are moved up and down within one segment.

(<) (>) : A segment is moved up and down within one pattern.

(PTN) : Patterns (1 to 9) are moved.

(SEL) : Returns to the channel menu.

Key operation on PID setting channel

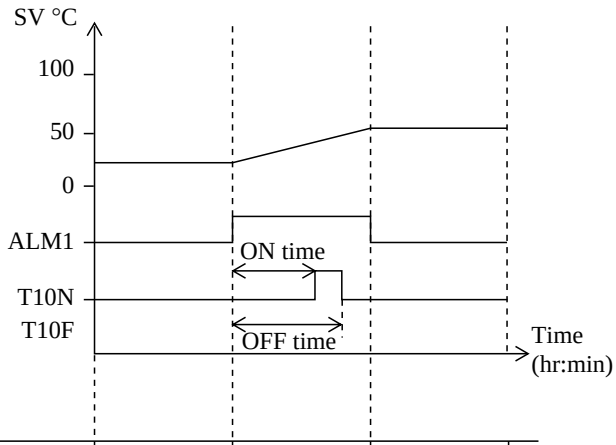
(∧) (∨) : Various parameters are moved up and down within one PID group.

(<) (>) : PID groups (1 to 9) are moved right and left.

(SEL) : Returns to the channel menu.

2. Program Pattern Setting (Program Pattern Setting Channel)

2.1 Program pattern structure

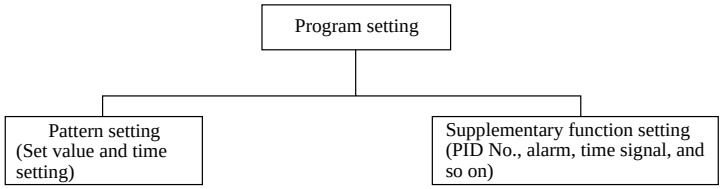


[Programming map]

Segment					1	2	3	
		Display	Setting range	Notation				
Pattern	Set value	Set value	0 to 10000	Engineering unit	25	50	50	
	Time	Time	0:00 to 99:59	hr:min or min:sec	1. 00	3. 00	2. 00	
PID No.		Pidn	1 to 9	Number	1	2	1	
Alarm 1 set value		AL01	0 to 10000	Alarm display		50		
⋮								
Alarm 4 set value		AL04						
Time signal 1 ON time		t1on	0:00 to 99:59	hr:min or min:sec		2. 00		
Time signal 1 OFF time		t1oF	0:00 to 99:59	hr:min or min:sec		2. 30		
⋮								
Time signal 6 ON time		t6on						
Time signal 6 OFF time		t6oF						
Guarantee soak Yes/No		GS	YES/no	YES/NO	no	no	YES	
Guarantee soak type		GSTP	0:Up and down 1:Down 2:Up		0	0	0	
PV start		PVST	YES/no	YES/NO	YES			
Number of cyclic operations		CYCL	oFF 0 to 99	OFF or 1 to 99	oFF			
Link pattern No.		Lnk	oFF 1 to 9	OFF or 1 to 9	oFF			

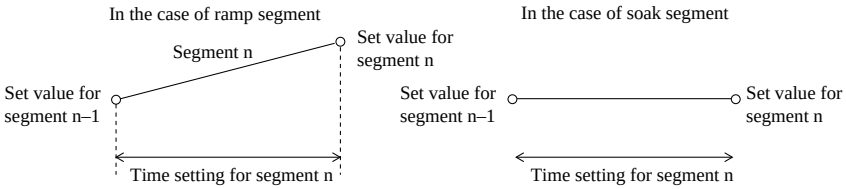
The programming for this unit can be accomplished by setting parameters necessary for each of segments.

For each segment setting, the pattern setting (Setting of set value and time) and other supplementary functional setting (such as PID number, alarms, and time signal) are required.


Program setting
Pattern setting (Set value and time setting)
Supplementary function setting (PID No., alarm, time signal, and so on)

1) Pattern setting

- The pattern setting includes the setting of a set value and time for each segment.
- Segment “n” would be a segment to which the process will flow from the set value for segment “n-1” to the set value for segment “n” at the time set for segment “n.”


In the case of ramp segment
Segment n
Set value for segment n
Set value for segment n–1
Time setting for segment n
In the case of soak segment
Set value for segment n–1
Set value for segment n
Time setting for segment n

Example 1) In the event of segment 2 (n=2) on the programming map (Pages 2-2):

A pattern in which the process will flow from 25°C (set value for segment 1) to 50°C (set value for segment 2) in 3:00 hours(time setting for segment 2). This is called “ramp segment.”

Example 2) In the event of segment 3 (n=3) on the programming map (Pages 2-2):

A pattern in which the process will flow from 50 °C (set value for segment 2) to 50 °C (set value for segment 3) in 2:00 hours(time setting for segment 3).This is called “soak segment.”

- The first segment will always be a soak segment, because of no set value for segment “n-1.”

Example 3) For segment 1 on the programming map (pages 2-2), the process will be soaked for 1:00 hour (time setting for segment 1) at a temperature of 25 °C (set value for segment 1).

2) Setting for other supplementary functions

The setting of some supplementary functions is made for each segment, while the setting of others is made only for one in a pattern.

Parameters to be set for each segment

- Setting of PID group number
- Setting of alarms 1 to 2 (or 1 to 4)
- Setting of time signals 1 to 4 (or 1 to 6)
- Setting of guarantee soak

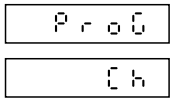
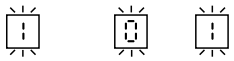
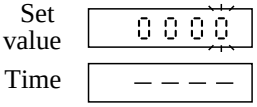
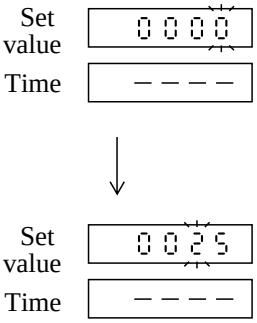
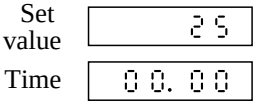
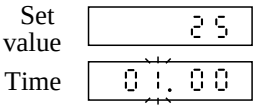
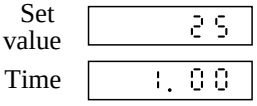
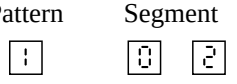
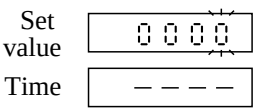
Parameter to be set only for one in a pattern

- PV start specification
- Cycle setting
- Setting of pattern link

For particulars of each setting, see an appropriate section for each parameter.

2.2 Pattern Setting ..... [Setting of a set value (SV) and time]

Segments 1 through 3 are registered according to the examples of program patterns.

Step	Applicable key(s)	Display	Explanation	Operation profile
Invoking a parameter	SEL ▽		Program setting channel menu is invoked. See "1. Parameter structure and Parameter calling method."	○—○
	SEL		Enters the program setting channel. Pattern and segment displays will blink.	
Entering the setting mode (set value)	ENT		Enters the set value mode and the set value will blink.	
Changing data (set value)	△ ◁ ▷ ▽		By using ▽, △, ◁, and ▷ keys, the data is changed to 25. ▽△ : For decrement and increment of data ◁▷ : For selecting columns	○—○
Entering the data entry set mode (time)	ENT		The set value blinking will terminate and the data "25" is entered. Concurrently, the time setting will blink, entering into the time setting mode.	
Changing data (time)	△ ◁ ▷ ▽		The data is changed to 1.00.	
Entering data (time)	ENT		The time setting blinking will terminate and the data "1.00" is entered.	
Invoking parameter (segment change)	▷		Segment 2 is invoked.	○＼○
Entering the set value mode	ENT			

Step	Applicable key(s)	Display	Explanation	Operation profile
Changing data	∧ ＜ ＞ ∨	Set value 0050 Time -----	The set value is changed to "50"	
Entering the data entry time setting mode	ENT	Set value 50 Time 00.00		
Changing data (time)	∧ ＜ ＞ ∨	Set value 50 Time 03.00	The time is changed to "3.00."	
Entering data (time)	ENT	Set value 50 Time 3.00		
Invoking Parameter	＞	Pattern 1 Segment 03	Segment 3 is invoked.	
Entering the set value mode	ENT	Set value 0000 Time -----		
Changing data	∧ ＜ ＞ ∨	Set value 0050 Time -----	The set value is changed to "50"	
Entering the data entry time setting mode	ENT	Set value 0050 Time 00.00		
Changing data	∧ ＜ ＞ ∨	Set value 50 Time 02.00	The time is changed to "2.00."	
Entering data	ENT	Set value 50 Time 2.00		

Note: Depress DSP key for returning to the operating screen.

2.3 Setting of supplementary functions

2.3.1 Setting of PID group

Set value
Time
PIDn
ALM1 〉 ALM4
r1on r1oF 〉 r6on r6oF
GS
GSrP
PoSr
CYCL
Link

Explanation

The PID group number (l to 9) is set for the use in that segment. In this manual, the grouping of P, I, and D parameters and output limiters to be used for the control operation is called “PID group.” The setting of PID group contents is made through the PID setting channel.

Setting

1 ～ 9 : The PID group number is set.

A PID group number 2 is assigned to segment 2.

Step	Applicable key(s)	Display	Explanation
Invoking parameter	∧ < > ∨	Pattern 1 Segment 02 Set value PIDn Time 1	PIDN in segment 2 is invoked.
Entering the setting mode	ENT	Pattern 1 Segment 02 Set value PIDn Time 1 (blinking)	The data will blink.
Changing data	∧ ∨	Pattern 1 Segment 02 Set value PIDn Time 2 (blinking)	The set value is changed to “2.”
Entry	ENT	Pattern 1 Segment 02 Set value PIDn Time 2	The data blinking will terminate and the data is entered.

2.3.2 Setting of alarm values 1 to 4

Set value

Time

PIdn

ALA1 ⟩ ALA4

f1on f1oF ⟩ f6on f6oF

GS

GSrP

PGSr

CyCL

LCnt

Explanation

A set value is established for the alarm to be generated in that segment. The alarms are provided at two points (ALMl and ALM2) as a standard and, optionally, it may be expanded to a total of four points (with additional points ALM3 and ALM4).
For setting, engineering units are used. The setting range is 0 to 100% of the input range.

Setting

0 to 100% (To be displayed in engineering units.)

Example) Where the input range of an instrument is 0 to 400°C, a value 300 is used for the setting, if the alrm is to be generated at 300°C.

Associated parameters

AL1r ~ AL4r : Alarm type
(See System Setup Parameters)

A1hS ~ A4hS * : Alarm hysteresis
(Expert parameter)

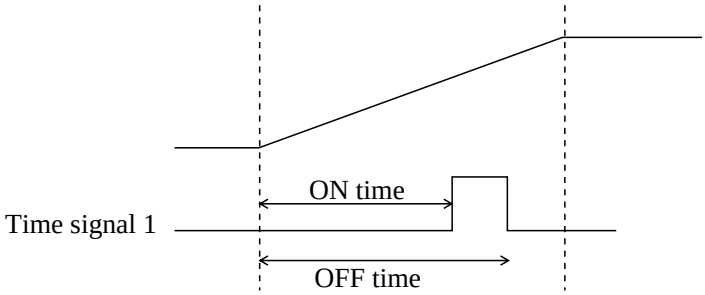
*: A change of the setting is not required for the ordinary use.

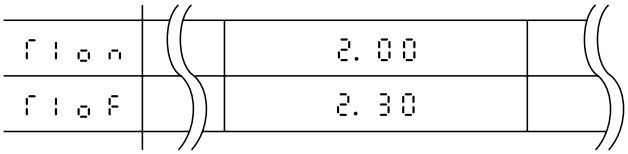
2.3.3 Setting of time signal

Set value
Time
PCdn
ALA1 ⟩ ALA4
r1on r1oF ⟩ r6on r6oF
GS
GSrP
PuSr
CyCL
LCnt

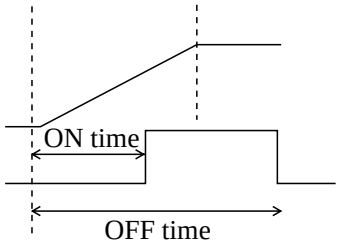
Explanation

A time setting is made for the time signal.
The time signal will function to turn on/off the digital output (open collector) according to the program running. For this unit, 4-point or 6-point time signal may be provided.
The time signal setting can be established by setting an ON time and OFF time starting from the beginning of a segment to be set.





- The time may be set even beyond the segment. Where, however, a time is set again in the later segment, the preceding time setting will be nullified and the present time setting will be validated because one timer is provided for each time signal.



- In one segment only one ON and one OFF setting are allowed for each time signal.
- In the reset state the time signal outputs will be all OFF.
- The time signal timer will be stopped in the holding state.
- The time signal output immediately before the end of operation will be retained when the unit operation is ended.

Setting

----------	:	No setting
0.00 to 99.59	:	0 hr:0 min to 99 hr:59 min (or 0 min:0 sec to 99 min:59 sec)

Associated parameters

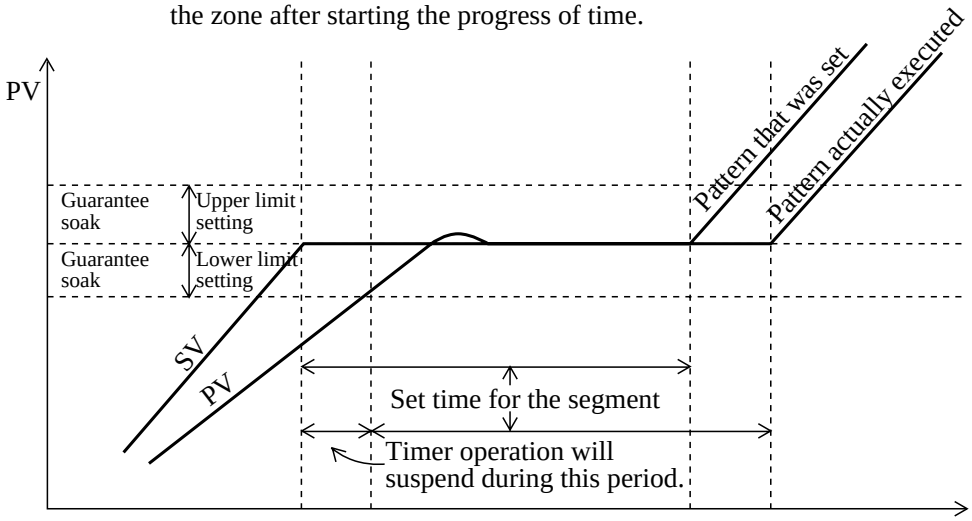
rnn	:	Time unit setting (switching between hr:min and min:sec) (System setup parameter)

2.3.4 Guarantee soak ..... (Waiting for PV to follow)

Set value
Time
PIdn
ALA1 ⟩ ALA4
r1on r1oF ⟩ r6on r6oF
GS
GSrP
PGSr
CYCL
LCnt

Explanation

- This is a function to suspend the timer operation at the beginning of a segment for waiting, where the Process variable fails to follow the running program in the program control.
  When the Process variable enters a specified zone, the timer operation will start again.
- The waiting is performed only once at the beginning of the segment. Therefore, the timer operation will not be suspended again after the Process variable once enters the guarantee soak zone and leaves out of the zone after starting the progress of time.



Setting

GS — Guarantee soak provided or not provided

- YES : Guarantee soak provided
- no : Guarantee soak not provided

GSrP — * Guarantee soak type (Expert parameter)

- 0 : Wait until the PV enters the upper and lower zones. (Standard)
- 1 : Wait until the measured value enters the lower zone.
- 2 : Wait until the measured value enters the upper zone.

* Note that this is an expert parameter and is displayed only when Expert (2) is selected in the user level setting (USER).

Associated parameters

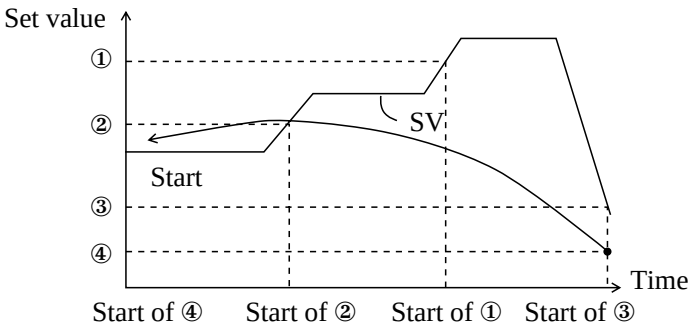
- GS—H : Guarantee soak upper limit setting (system setup parameter)
- GS—L : Guarantee soak lower limit setting (system setup parameter)
- GSrM : Guarantee soak max. wait time (system setup parameter)

2.3.5 PV Start ..... (Allowing the program to start from the current PV)

Set value
Time
PCdn
ALA1 ⟩ ALA4
r1on r1oF ⟩ r6on r6oF
GS
GSrP
PuSr
CYCL
LInt

Explanation

This function includes the seeking of a first point at which the PV matches the program pattern after the start of a program and the starting of the unit operation from that point.



Note: Where there is no match point as in case ④, the operation will start from the first segment.

- There is no difference between the PV start and the ordinary start in the time-dependent relation between the program pattern and other supplementary functions, such as time signal.

Setting

yES : PV start available

no : PV start unavailable

Supplement

Only one parameter assignment is allowed for a single pattern. (The setting is possible for any segment)

2.3.6 Cyclic Operation..... (Repetitious execution of a pattern)

Set value

Time

PIdn

ALM1
⟩
ALM4

F1on
F1oF
⟩
F6on
F6oF

GS

GSrP

PUSr

CYCL

LInt

Explanation

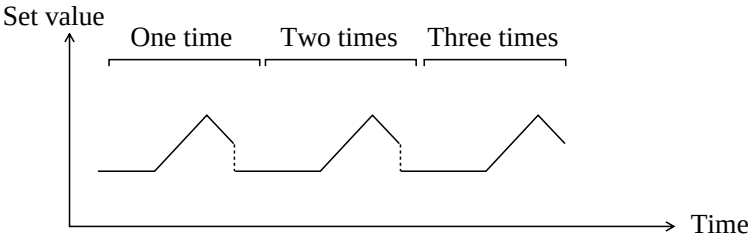
This is a function for the repetitious execution of the same program pattern. Where the number of cyclic operations is assigned, the re-start will begin with the first segment after the completion of the final segment.

- For the number of cyclic operations, the number of times of repetititious operations is assigned for the setting. Therefore, the number of times of the actual execution would be the number of cyclic operations plus one.

  Number of times of execution = Set value for cyclic operation + 1[time]

Example) Where a program pattern is executed three times:

"2" is assigned to "CYCL"



Setting

OFF : Cyclic operation is not performed.

1 ～ 99 : The number of times of repetition (Cyclic operations are performed)
(The program pattern will be executed "set value + l" times)

Supplement

Only one parameter assignment is allowed for a single pattern.
(The setting is possible for any segment.)

2.3.7 Pattern-Link Operation ..... (Successive pattern execution)

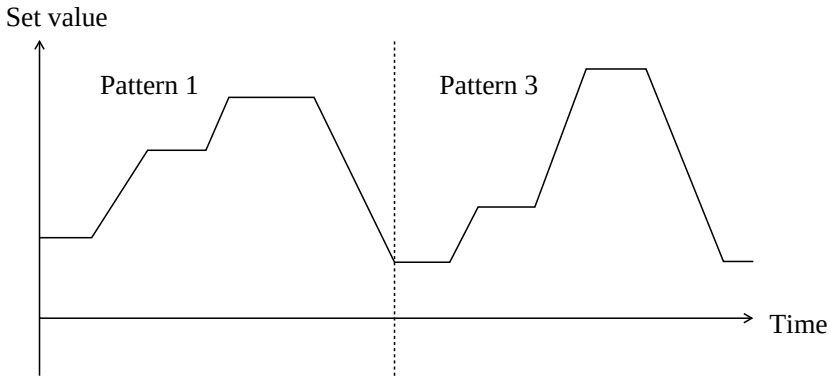
Set value
Time
PCdn
AL01 ⟩ AL04
r1on r1oF ⟩ r6on r6oF
GS
GSrP
PGSr
CyCL
LCnt

Explanation

This is a function for the consecutive execution of one pattern after the other pattern is completed. For a program pattern with a link pattern number assigned, the first segment with the assigned pattern number will be executed after the final segment is completed.

Example) Where pattern 3 is executed consecutively after pattern 1:

“ 3 ” is assigned to “ LCnt ” in pattern 1.



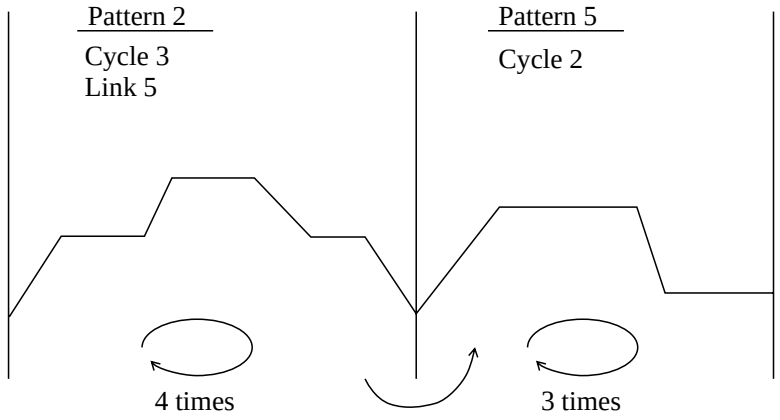
Setting

OFF : Pattern link operation is not performed.

1 ~ 9 : After one pattern is completed, a pattern with assigned number is executed consecutively.

Relationship between link pattern and cyclic operation

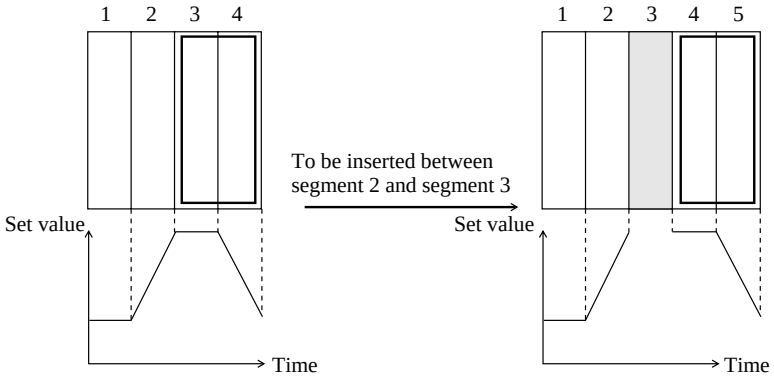
The cyclic operation and the pattern link operation can be assigned in combination. In this case, the cyclic operation is preferentially executed; after completion of the cyclic operation, the link pattern will be executed.



2.4 Editing Program Pattern

2.4.1 Segment insertion (a new segment is created between segments)

A new segment is inserted between segments.



Key operation	Display	Explanation
	PrOG Ch	This display is generated by referring to section 1.3 Parameter Setting Overview.
	4 03 50 30	A pattern and a segment are selected. By depressing (INS) key, the segment is inserted. As a result, the previous segment is shifted backward by one segment.
(INS)	4 03 -- -- -- --	

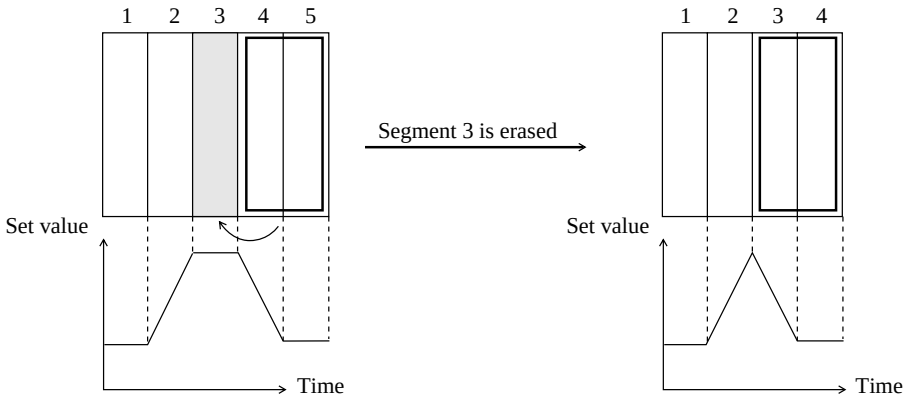
⚠ CAUTION

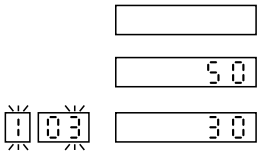
This product enables insertion operation, despite the setting of the “User level” and “Setting lock,” which are described in Section1-3 “Parameter Setting Overview.”

In order to prevent insertion operation, preset all the patterns and segments accordingly.

2.4.2 Segment erasure (a segment in a pattern is erased)

A segment is erased from a program pattern.



Key operation	Display	Explanation
	PrOG Ch	This display is generated by referring to Section 1.3 Parameter Setting Overview.
SFT CLR DSP		A segment to be erased is selected. The SFT key and DSP key are depressed. The segment is erased and the succeeding segment is shifted forward for the setting.

⚠ CAUTION

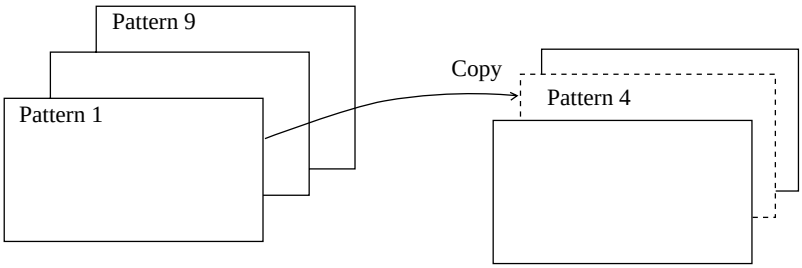
This product enables deletion operation despite the setting of the “User level” and “Setting lock,” which are described in Section 1-3, “Parameter Setting Overview.”

Carry out deletion operation with care, as not to execute it inadvertently.

2.4.3 Copying a pattern

A created program pattern is copied to another pattern.

Example) Pattern 1 is copied to Pattern 4.



Key operation	Display	Explanation
	PrOG Ch	This display is generated by referring to Section 1.3 Parameter Setting Overview.
COPY SFT → ENT ∧ ∨	 FroM 4 05 1	The program pattern sender assignment status is established by depressing SFT key and ENT key. A sender is assigned by using ∧ and ∨ keys.
ENT ∧ ∨	 To 4 05 4	By depressing ENT key, receiver assignment status is established. A receiver is assigned by using ∧ and ∨ keys.
ENT	 CoPY 4 05 donE	Copying operation will start by depressing ENT key. After completing the copying operation, a display “Copy done” will be generated for a second.

⚠ CAUTION

This product enables pattern copy operation, despite the setting of the “User level” and “Setting lock,” which are described in Section1-3 “Parameter setting overview. ”

In order to prevent copying operation, preset all the segments and patterns accordingly.

Cautions in the copying operation

- Prior to the generation of the sender pattern, the program must be registered for entry. The selection of an unassigned pattern at the sender will result in a sender error.

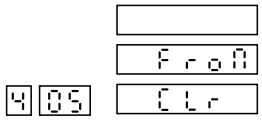
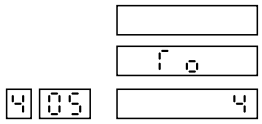
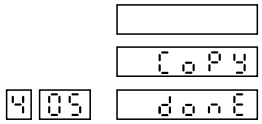
FroM / Error (Sender error)

- The receiver pattern must be erased. The selection of an assigned pattern at the sender will result in a receiver error.

To / Error (Receiver error)

2.4.4 Pattern erasure

Part of a program pattern is erased.

Key operation	Display	Explanation
	PrOG Ch	This display is generated by referring to Section 1.3 Parameter Setting Overview.
COPY SFT → ENT △ ▽		By depressing SFT key and ENT key, the program pattern sender assignment status is generated. A display "CLR" is generated by depressing △ key.
ENT △ ▽		The destination assignment status is generated by depressing ENT key. Using △ key and ▽ key, a program pattern to be erased is specified.
ENT		The erasing operation is performed by depressing ENT key. After completing the erasing, a display "Copy done" will appear for a second.

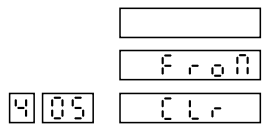
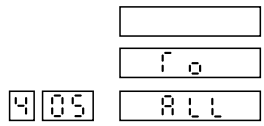
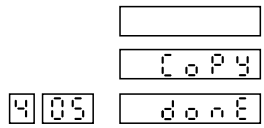
⚠ CAUTION

This product enables deletion operation despite the setting of the "User level" and "Setting lock," which are described in Section 1-3, "Parameter Setting Overview."

Carry out deletion operation with care, as not to execute it inadvertently.

2.4.5 Erasure of all patterns

All the program patterns are erased.

Key operation	Display	Explanation
	PrOG Ch	This display is generated by referring to section 1.3 Parameter Setting Overview.
COPY SFT → ENT △ ▽		By depressing SFT key and ENT key, the program pattern sender assignment status is generated. A display "CLR" is generated by depressing △ key.
ENT △ ▽		The destination assignment status is generated by depressing ENT key. A display "ALL" is generated by depressing △ key.
ENT		All patterns are erased by depressing ENT key. After erasing, a display "Copy done" will appear for a second.

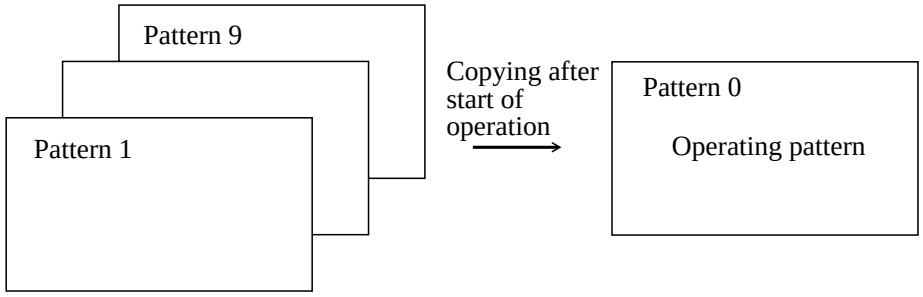
⚠ CAUTION

This product enables deletion operation despite the setting of the "User level" and "Setting lock," which are described in Section 1-3, "Parameter Setting Overview."

Carry out deletion operation with care, as not to execute it inadvertently.

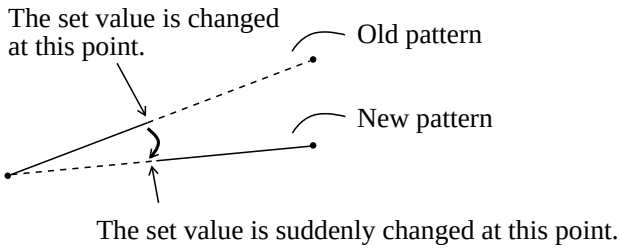
2.4.6 Change of running program

This unit operates only when a set pattern has been copied to a running pattern (Pattern 0) in the pattern start timing. That is, the operation is always performed in pattern 0. For this reason, any change in patterns 1 through 9 during the operation will have no impact on the running operation. Change pattern 0, if any change is required for running program. (In this case, the operation will have no impact by the change of a segment already executed)



Caution: A set value will be suddenly changed according to a new setting when a set value and time are changed in the segment under the execution. (In the case of the ramp segment)

The change of a set value or time for the segment under execution should be avoided, if an abrupt change in the set value is undesirable.



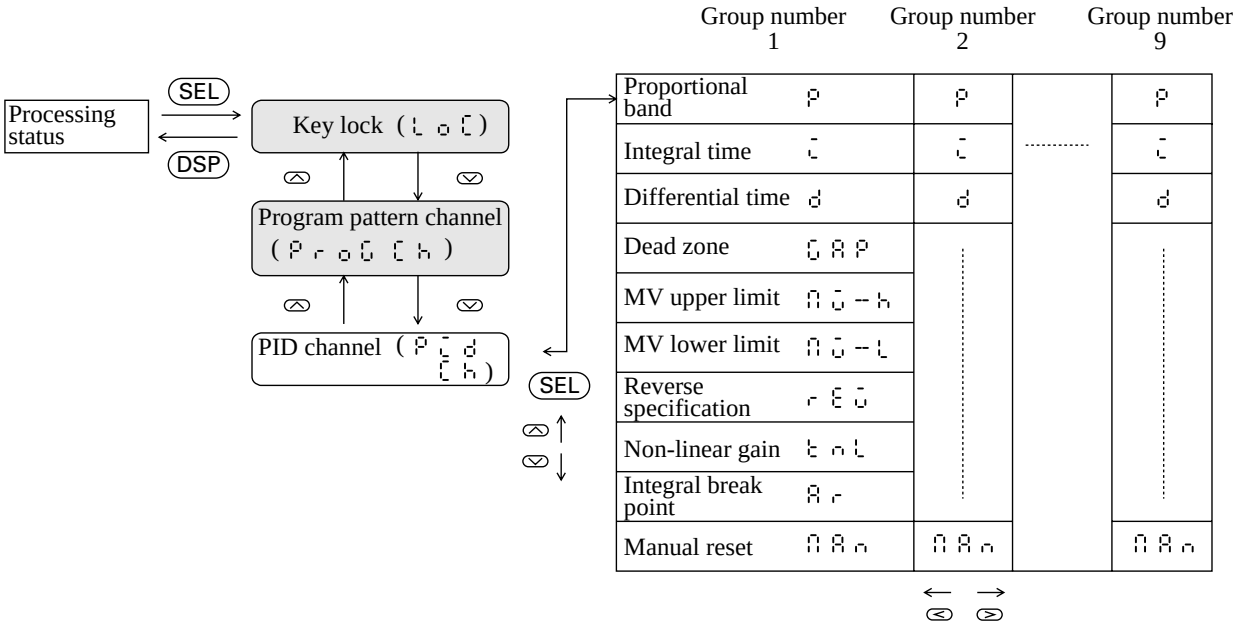
3. Setting of PID Group (PID Setting Channel)

3.1 Structure of PID Setting Channel

A group of control parameters such as P,I, and D is assigned.

For this unit, a lump sum of control paramters such as P, I, and D manipulating value limits (MV limits) is called “PID group.” Nine types of PID groups are available for setting.

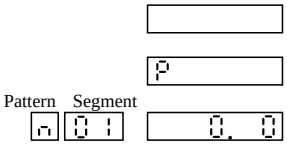
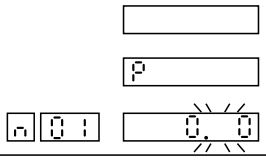
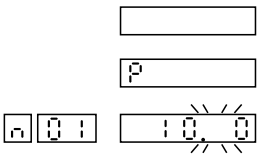
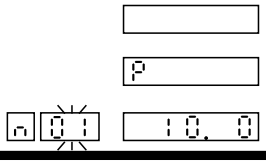
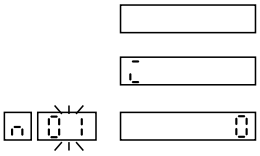
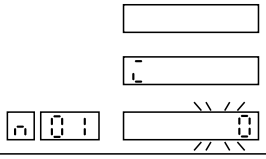
When running a program, select and use one out of the nine types of control parameters for each segment. (See PID number parameters)

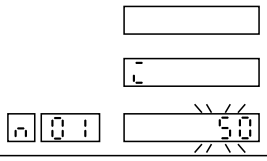
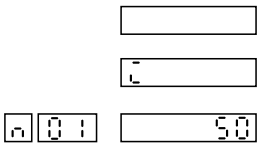
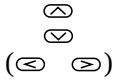
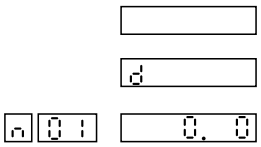
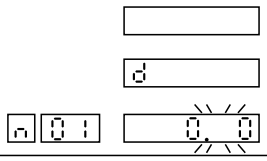
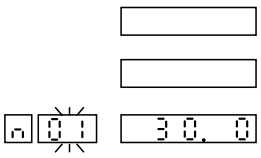
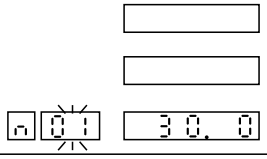


Code	Name		Setting range	Notation	Remarks
P	P	Proportional band	0.0 to 999.9	%	
I	I	Integral time	0 to 3200	Second	
d	d	Differential time	0.0 to 900.0	Second	
GAP	GAP	Dead zone	0 to 50% of input range	Engineering unit	
MV-H	MV-H	Manipulating value (MV) Upper limit	–5.0 to 105.0	%	
MV-L	MV-L	Manipulating value (MV) Lower limit	–5.0 to 105.0	%	
rEV	REV	Reverse operation assignment	YES: Reverse operation no : Normal operation	YES/NO	
knL	KnL	Non-linear gain	–327.7 to 327.7%	%	Expert parameter
Ar	Ar	Integral break point	0 to 100% of input range	Engineering unit	
MAn	MAN	Manual reset	–5.0 to 105.0	%	

3.2 Setting of each parameter

For PID group number 1, the following setting is made:
P=10.0%, I=50 seconds, and D=30.0 seconds.

Step	Applicable key	Display	Explanation
Invoking parameter (P)			PID ch is invoked by referring to “1. Parameter Structure and Calling Method.”
	(SEL)		By depressing (SEL) key, the proportional band display will appear and concurrently the segment display will blink. A number in the segment represents a pertinent PID group number.
	◁ ▷		Use ◁ and ▷ keys to assign the PID group number. In this case, the PID group number "1" is assigned and no operation is required.
Entering data setting mode	(ENT)		Depress (ENT) key. The time display will start blinking.
Changing data	△ ◁ ▷ ▽		Use ▽, △, ◁ and ▷ keys to change the numerical value for the proportional band. In this case, 10% is used.
Entry	(ENT)		Depress (ENT) key. The PID group number will blink again.
Invoking parameter (I)	△ ▽ (◁ ▷)		By depressing ▽ key, the integral time (I) display will appear. (Use ◁ and ▷ keys to change any other group number.)
Entering data setting mode	(ENT)		Depress (ENT) key to bring a state in which the integral time can be input. Then the time display will start blinking.

Step	Applicable key	Display	Explanation
Changing data			Use ⌄, ⌃, ⌄, and ⌄ keys to change the numerical value for the integral time.In this case, 50(seconds) is set.
Entry	ENT		Depress ENT key. The PID group number will blink again.
Invoking data (D)			By depressing ⌄ key, the differential time (D) display will appear. (Use ⌄ and ⌄ keys to change any other group number.)
Entering data setting mode	ENT		Depress ENT key to bring a state in which the differential time can be input. The time display will then blink.
Changing data			Use ⌄, ⌃, ⌄, and ⌄ keys to change the numerical value for the differential time. A value of 30.0(seconds) is used in this case.
Entry	ENT		Depress ENT key, so that the segment display will blink.

3.2.1 Setting of proportional band (P), integration time (I), and differentiation time (D)

P
I
d
GAP
AJ-h
AJ-L
rEJ
tnL
Ar
MAn

Explanation

The proportional band (P), Integral time (I), and differential time (D) are assigned for the PID control.

Setting

1) Proportional band (P)
   0.0% : Two position control is performed.
   0.1 to 999.9% : PID control is performed.
2) Integral time (I)
   0 [sec] : The integral operation is eliminated.
   1 to 3200[sec] : An integral time is assigned.
3) Differential time (D)
   0.0[sec] : The differential time is eliminated.
   0.1 to 900.0[sec] : A differential time is assigned.

Associated parameters

GAP The dead zone setting is required when the two position operation is performed with P=0.

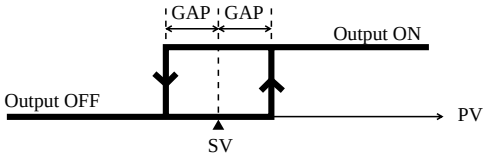
3.2.2 Setting of dead zone

P
I
d
GAP
AJ-h
AJ-L
rEJ
tnL
Ar
MAn

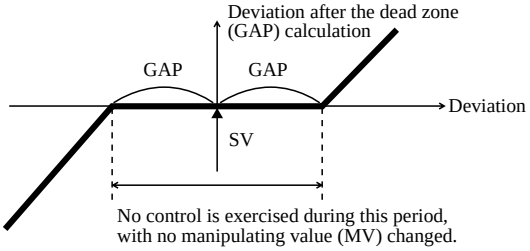
Explanation

The dead zone functional operation will vary with the value of P.

1) P = 0 ····· In the two position operation
   This function is to improve the control stability through the prevention of the output fluctuation in the neighborhood by shifting the operating point at the time when the Process variable rises and falls.



2) P ≠ 0 In the PID control
   This function is to reduce wasteful manipulation to a minimum by suspending the control, with the deviation (DV) set to "0" in the neighborhood of the set value.
   This function is used, where the PV may be in the neighborhood of the set value (a reasonable amount of offset is allowed), as in the liquid level control in a tank.


Deviation after the dead zone (GAP) calculation
GAP
GAP
Deviation
SV
No control is exercised during this period, with no manipulating value (MV) changed.

Setting

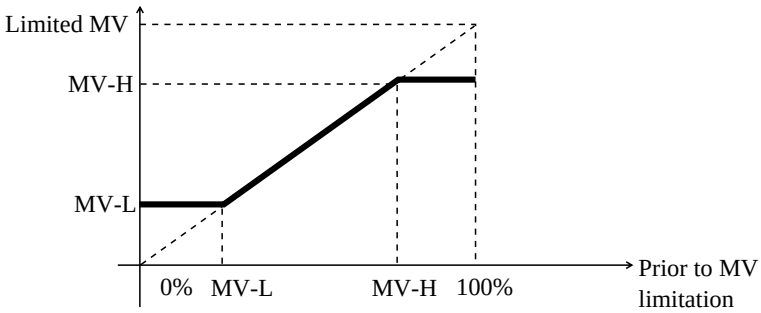
0 to 100% of input range :
Display in engineering unit

3.2.3 Manipulating value (MV) upper and lower limits

P
I
d
GAP
MG-H
MG-L
rEG
tnL
Ar
MAn

Explanation

The upper limit and the lower limit of manipulating value (MV) are determined by set values, where the limitation of manipulating value (in upward or downward movement) is required for processing reason or for the convenience of an operating terminal.
When manipulating value (MV) is limited, the I operation in the direction that the MV is leaving from the limit value will be cut, therefore, preventing an over-integration by the limitation.



Setting

MG-H Upper limit of manipulating value (MV)

–5.0 to 105.0%

MG-L Lower limit of manipulating value (MV)

–5.0 to 105.0%

Caution

Set the MV-H and MV-L so that the MV-H is greater than MV-L.

3.2.4 Reversing specification

P
I
d
GAP
MG-H
MG-L
rEG
tnL
Ar
MAn

Explanation

This parameter is to change over the control; from the normal operation to the reverse operation, or vice versa.

Normal operation : to be used for a process in which the PV falls with an increment of the MV.
Reverse operation: to be used for a process in which the PV rises with an increment of the MV.

Setting

YES :For reverse operation

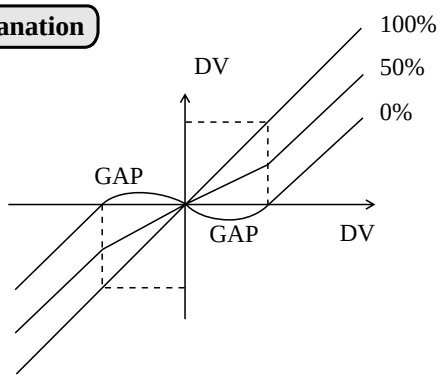
no :For normal operation

3.2.5 Non-linear gain

Expert parameter

P
I
d
GAP
AG-h
AG-L
rEG
tnL
Ar
MAn

Explanation



This function performs the setting of dead zone (GAP) and the control of a non-inear gain.
By using this function, the non-linear gain can be controlled by making the gain larger or smaller in the neighborhood of the set value (SV).

Setting

–327.6 to 327.6%

Associated parameters

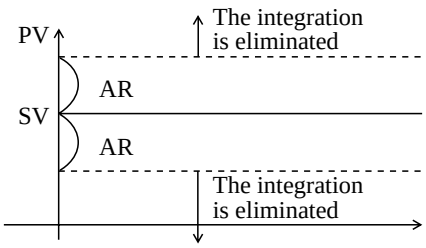
GAP	Dead zone

3.2.6 Integration break point

Expert parameter

P
I
d
GAP
AG-h
AG-L
rEG
tnL
Ar
MAn

Explanation



If the integral operation is involved in the control operation, an overshoot will occur due to an overintegration at the initial stage.
The overshoot is therefore prevented by limiting the range of the integral operation. This setting is made for an upper and lower limits with respect to the SV.

Setting

0 to 100% (Engineering unit) of the input range

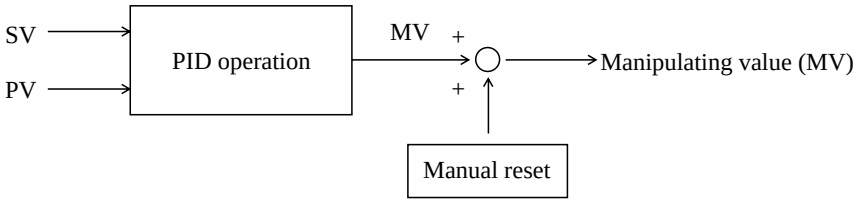
3.2.7 Manual reset

Expert parameter

P
I
d
CAP
AL-H
AL-L
rEG
tnL
Ar
MAn

Explanation

The setting is made to assign "0" to the offset (steady-state deviation) when using the unit only with P operation.
This set value is added to the MV for the output.



Setting

–25.0 to 125.0%

SECTION 3 SETTING UP ... Start-up and specification changes

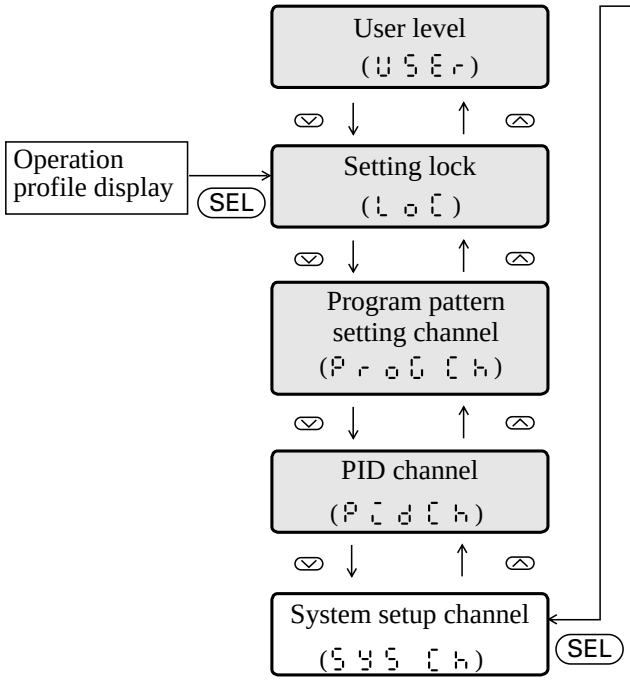
Read this section carefully when incorporating this unit into a system and starting up the system.

It is assumed that the reader of this section is already familiar with the basic operating method of this unit. If not, the reader should read SECTION 1 BEFORE STARTING OPERATION before proceeding to this section.

1. Structure of System Setup Channel

What is System Setup Channel?

The system setup channel is a channel through which basic parameters, such as the input specifications of PV and type of alarm, are set for the use of this unit to be incorporated into the system.
The setting and confirmation of parameters for this channel are required at the time of the system start-up or when the specifications are changed.



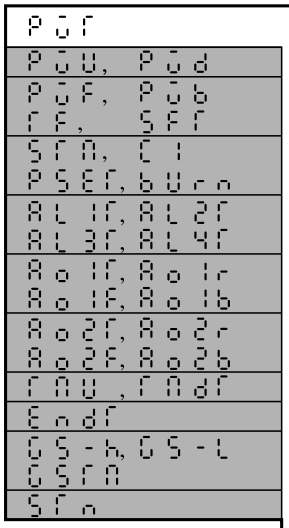
The system setup channel display will appear only when the user level is set to '1' (Set maker).

PV input type	PvT
PV unit	Pvu
PV full scale	PvF
PV base scale	Pvb
Position of decimal point	Pvd
Time constant of filter	rF
PV shift	SFr
Start mode	Srn
MV proportional period	C1
Preset MV value	PSEr
MV at burnout	bUrn
Alarm 1 type	AL1T
Alarm 2 type	AL2T
Alarm 3 type	AL3T
Alarm 4 type	AL4T
AO 1 output type	Ao1T
AO 1 output range type	Ao1r
AO 1 full scale	Ao1F
AO 1 base scale	Ao1b
AO 2 output type	Ao2T
AO 2 output range type	Ao2r
AO 2 full scale	Ao2F
AO 2 base scale	Ao2b
Time unit	rMU
Time display type	rMdT
END signal output time	EndT
Guarantee soak - Upper limit	GS-h
Guarantee soak - Lower limit	GS-L
Guarantee soak - Max. wait time	GSrM
Station number	Sn

Code	Name		Setting range	Notation	Remarks
PVT	PVT	PV input type	See Input code table	–	
PVU	PVU	PV unit	0: °C 1: °F	–	PVT Either one is displayed depending on the PV input type.
PVF	PVF	PV full scale	0 to 1000	–	
PVB	PVB	PV base scale	0 to 1000	–	
PVD	PVD	Position of decimal point	0: No decimal position 1: the first decimal position 2: the second decimal position 3: the third decimal position	–	
TF	TF	Time constant of filter	0.0 to 900.0	Second	
SFT	SFT	PV shift	–50.0 to 50.0% of the input range	Engineering unit	
STM	STM	Start mode	0: Continuous start 1: Reset start	–	
C1	C1	MV proportional period	1 to 120	Second	To be displayed if relay or SSR drive output.
PSET	PSET	Preset MV value	–5 to 105.0	%	
BURN	BURN	MV set value at burnout	–5 to 105.0	%	
AL1T	AL1T	Alarm 1 type	See Alarm Type Table.	–	To be displayed if expanded alarms (3&4) are installed.
AL2T	AL2T	Alarm 2 type	See Alarm Type Table.	–	
AL3T	AL3T	Alarm 3 type	See Alarm Type Table.	–	
AL4T	AL4T	Alarm 4 type	See Alarm Type Table.	–	
Ao1T	AO1T	AO 1 output type	0: PV 1: SV 2: MV	–	To be displayed if auxiliary analog signal output is provided.
Ao1R	AO1R	AO 1 output range type	0: 1–5V 1: 0–5V 2: 0–10V	–	
Ao1F	AO1F	AO 1 full scale	0 to 100.0% of the input range	Engineering unit	
Ao1B	AO1B	AO 1 base scale	0 to 100.0% of the input range	Engineering unit	
Ao2T	AO2T	AO 2 output type	0: PV 1: SV 2: MV	–	To be displayed if 2-point auxiliary analog signal output is provided.
Ao2R	AO2R	AO 2 output range type	0: 1 to 5V 1: 0 to 5V 2: 0 to 10V	–	
Ao2F	AO2F	AO 2 full scale	0 to 100.0% of the input range	Engineering unit	
Ao2B	AO2B	AO 2 base scale	0 to 100.0% of the input range	Engineering unit	
TMU	TMU	Time unit	0: hr:min 1: min:sec		
TMDT	TMDT	Time display type	0: remaining time 1: lapsed time		
ENDT	ENDT	END signal output time	0 to 99.59	Hr:Min (Min:Sec)	TMU Hr:min or min:sec display depending on the setting of time unit.
GS-H	GS-H	Guarantee soak: upper limit	0 to 50.0	Engineering unit	
GS-L	GS-L	Guarantee soak: lower limit	0 to 50.0	Engineering unit	
GSTM	GSTM	Guarantee soak: max. wait time	00 to 99.59	Hr:Min (Min:Sec)	TMU Hr:min or min:sec display depending on the setting of time unit.
STN	STN	Station number	00 to 99		To be displayed only when T-link transmission is provided.

2. Setting of Each Parameter

2.1 Setting of PV input type and input range



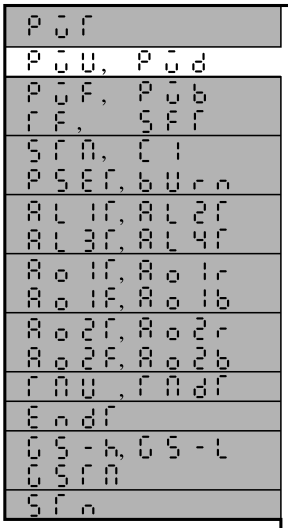
Explanation The PV input type and the input range are selected from the table below so that the setting can be made in codes.

Table 1. Input signal and manipulation range

Input signal		Input type	Manipulation range Code (°C)	Manipulation range Code (°F)	0.1 °C notation	0.1 °F notation
Resistance bulb, JIS(IEC)	Pt100	00	0 to 150°C	32 to 302°F	○	○
	Pt100	01	0 to 300°C	32 to 527°F	○	○
	Pt100	02	0 to 500°C	32 to 932°F	○	○
	Pt100	03	0 to 600°C	32 to 1112°F	○	×
	Pt100	04	–50 to 100°C	–58 to 212°F	○	○
	Pt100	05	–100 to 200°C	–148 to 392°F	○	○
	Pt100	06	–199.9 to 600°C	–328 to 1112°F	○	×
	Pt100	07	–199.9 to 850°C	–328 to 1562°F	○	×
Resistance bulb (Former JIS)	JPt100	10	0 to 150°C	32 to 302°F	○	○
	JPt100	11	0 to 300°C	32 to 527°F	○	○
	JPt100	12	0 to 500°C	32 to 932°F	○	○
	JPt100	13	0 to 600°C	32 to 1112°F	○	×
	JPt100	14	–50 to 100°C	–58 to 212°F	○	○
	JPt100	15	–100 to 200°C	–148 to 392°F	○	○
	JPt100	16	–199.9 to 600°C	–328 to 1112°F	○	×
Thermo-couple	J	20	0 to 400°C	32 to 752°F	○	○
	J	21	0 to 800°C	32 to 1472°F	○	×
	K	22	0 to 400°C	32 to 752°F	○	○
	K	23	0 to 800°C	32 to 1472°F	○	×
	K	24	0 to 1200°C	32 to 2192°F	×	×
	R	25	0 to 1600°C	32 to 2912°F	×	×
	B	26	0 to 1800°C	32 to 3727°F	×	×
	T	27	–199.9 to 200°C	–328 to 392°F	○	○
	T	28	–150 to 400°C	–238 to 752°F	○	○
	E	29	0 to 800°C	32 to 1472°F	○	×
	E	2A	–199.9 to 800°C	–328 to 1472°F	○	×
	S	2B	0 to 1600°C	32 to 2912°F	×	×
	N	2C	0 to 1300°C	32 to 2372°F	×	×
	U	2D	–199.9 to 400°C	–328 to 752°F	○	○
	WRe5-26	2E	0 to 2300°C	32 to 4172°F	×	×
	PL-II	2F	0 to 1300°C	32 to 3272°F	×	×
DC voltage	DC1 to 5V	40	From –999 to 9999 (Scaling range) * The current must be input on 1 to 5 volts, with a 250-ohm resistor (optional) connected to terminal numbers 38 and 39.			
	DC0 to 5V	41				
	DC0 to 10V	42				
	DC0 to 1V	43				
	DC0 to 100mV	44				
	DC0 to 10mV	45				
Direct current	DC4 to 20mV	40*				

Notes:
- The 0.1°C/°F notation is not provided for a temperature span greater than 1000°C/°F.
- No guaranty is provided for the accuracy at a temperature below –200°C.
- The LLLL display will not appear even with an input of zero ohm within a range from -199.9 to 850 for the resistance bulb input.
- For the resistance bulb input , the LLLL or UUUU display will appear when B-wire is broken.

2.2 Setting of PV display unit (°C or°F) and 0.1°C (°F) notation (for thermocouple or resistance bulb)


P G r
P U U, P U d
P u F, P u b
r F, S F r
S r A, C 1
P S E r, b U r n
A L 1r, A L 2r
A L 3r, A L 4r
A o 1r, A o 1r
A o 1F, A o 1b
A o 2r, A o 2r
A o 2F, A o 2b
r M U , r M d r
E n d r
G S - h, G S - L
G S r A
S r n

Explanation

The setting is made for temperature display; whether the PV is expressed in the unit of 1°C (°F) or 0.1°C (0.1°F).

The changeover between °C and °F is accomplished by the PV unit [P U U], while the changeover between 1°C and 0.1°C is done by the decimal point [P U d] position parameter.

Setting

[P U U] PV unit — 0: °C notation; 1: °F notation

[P U d] Position of decimal point — 0: 1°C notation; 1: 0.1°C notation

Note: If the input span exceeds 1000°C /°F, the display in the unit of 0.1°C /°F is not available.

Example of setting

1) The display in the unit of 0.1 is executed with an input temperature, –150 to 100 to the resistance bulb (JIS).
PVT=4 (Pt100 in the range from –150 to 100)
PVU=0 (°C notation)
PVd=1 (0.1°C notation)

2) The display in the unit of °F is executed with an input temperature of 0 to 400°C to K thermocouple.
PVT=22 (K in the range from 0 to 400°C)
PVU=1 (°F notation)
PVd=0 (1°F notation)

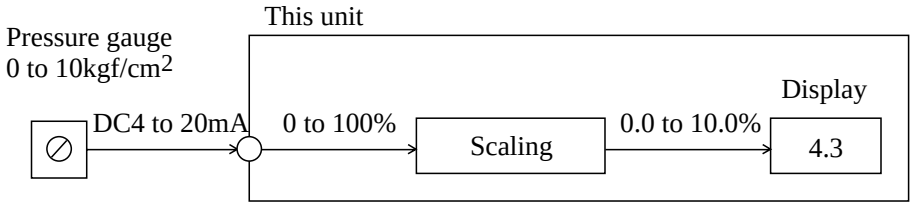
2.3 Setting of full scale and base scale in the engineering unit notation (for DC voltage and current input)

PVF PVU
PVF, PVb
PVd
rF, SFT
SrA, C1
PSEr, bUrn
AL1r, AL2r
AL3r, AL4r
Ao1r, Ao1r
Ao1F, Ao1b
Ao2r, Ao2r
Ao2F, Ao2b
rMV, rMdr
Endr
CS-h, CS-L
CSrN
Srn

Explanation

The DC voltage and the current are input within the range from 0 to 100% of the input range. The units of these values are converted (scaling) into units being used for actual processing (engineering units). Such units are called “engineering units.”
This unit permits the display of scaling an input measured value between 0 and 100% within the range from –999 to 9999.

Example) A display of 0.0 to 10.0 is obtained from the input value measured with a 0-10kgf/cm^2 pressure gauge by receiving the value at 4 to 20 mA DC.



Setting

PVF — PV full scale setting (–999 to 9999)
The setting is made for a desired value to be displayed at 100% input.

PVb — PV base scale setting (–999 to 9999)
The setting is made for a desired value to be displayed at 0% input.

PVd — Position of decimal point
The setting is made for a decimal place.

0: No decimal point	500
1: the first decimal position	50.0
2: the second decimal position	5.00
3: the third decimal position	.500

Note) The setting must be made so that the full scale setting is greater than the base scale setting.

Good example)
PVF=500
PVb=–250

Bad example)
PVF=–250
PVb=500

Example of setting

With an input of 4 to 20 mA DC a display of 0.0 to 10.0 will appear.

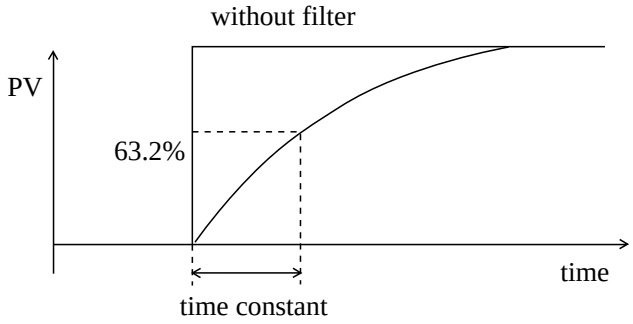
PVT = 40 ····· 4 to 20 mA DC input range code
PVF = 100 ····· A display of 100 by 100%(20 mA) input.
PVF = 0 ····· A display of 0 by 0% (4 mA) input.
PVd = 1 ····· The first decimal position

2.4 PV filter ..... (reducing the wander of PV arising from noise)

P.oF P.oU
P.oF, P.ob
P.od
r F,
SFr
SrA, C1
PSEr, bUrn
AL 1r, AL 2r
AL 3r, AL 4r
Ao 1r, Ao 1r
Ao 1F, Ao 1b
Ao 2r, Ao 2r
Ao 2F, Ao 2b
rAU, rAdr
Endr
GS-h, GS-L
GSrA
Srn

Explanation

The measurement fluctuation due to the input noise is reduced to a minimum. Where the value of P (proportional band) is small, a small variation of PV will produce a large MV, thus bringing about an effect of stabilizing the control with a filter. For this unit, a first-order-lag filter is used and the setting is made with a first-order-lag time constant.



The time constant is defined as a time required for the input value to attain 63.2% of the original input value.

Large ·····Slow
↑ ↑
Time constant ·····Response
↓ ↓
Small ·····Fast

Setting

r F Setting of PV filter time constant

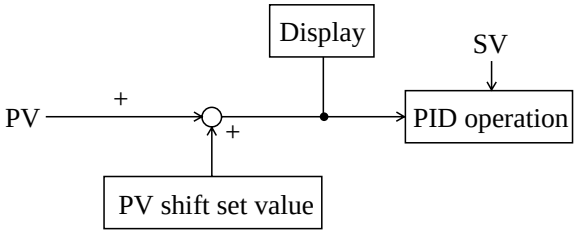
0.0 : PV filter is not used.
0.1 to 900.0 sec.: PV filter is applied according to the assigned time constant (second).

2.5 PV shift (shifting zero point of PV)

P.oF P.oU
P.oF, P.ob
P.od
r F,
SFr
SrA, C1
PSEr, bUrn
AL 1r, AL 2r
AL 3r, AL 4r
Ao 1r, Ao 1r
Ao 1F, Ao 1b
Ao 2r, Ao 2r
Ao 2F, Ao 2b
rAU, rAdr
Endr
GS-h, GS-L
GSrA
Srn

Explanation

This is a function to shift a PV by a set value.



Setting

SFr PV shift setting

–50% to 50% of the input range (Notation in engineering units)

2.6 Start mode ... (defining a startup mode at resumption of power supply)

PUT PUU
PUF, PUb
Pud
rF, SFT
SrA,
C 1
PSEt, bUrn
AL 1C, AL 2C
AL 3C, AL 4C
Ao 1C, Ao 1r
Ao 1F, Ao 1b
Ao 2C, Ao 2r
Ao 2F, Ao 2b
rAU, rAdT
EndT
GS-h, GS-L
GSrA
SFn

Explanation

The start mode is defined when the power supply is resumed. Two types of the start mode is available: continuous and reset.

Continuous: the operation at the time of power failure is resumed.
Reset : the reset state is established.

Setting

SrA Start mode

0: continuous
1: reset

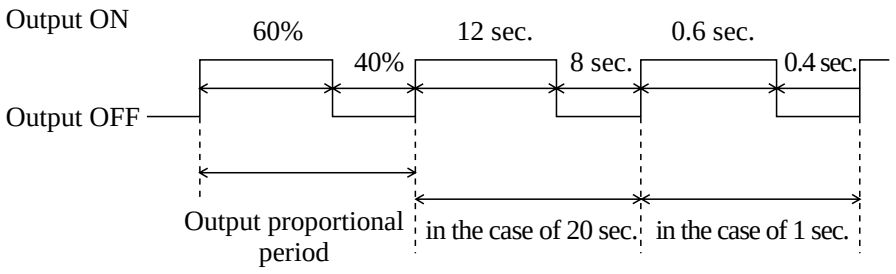
2.7 MV proportional period .... (for relay-drive or SSR/SSC-drive output)

PUT PUU
PUF, PUb
Pud
rF, SFT
SrA,
C 1
PSEt, bUrn
AL 1C, AL 2C
AL 3C, AL 4C
Ao 1C, Ao 1r
Ao 1F, Ao 1b
Ao 2C, Ao 2r
Ao 2F, Ao 2b
rAU, rAdT
EndT
GS-h, GS-L
GSrA
SFn

Explanation

This is the setting for the MV proportional period in the relay output or in the SSR/SSC-driven output.
In the relay output or the SSR/SSC-driven MV, the value of MV, 0 to 100%, is output by means of pulse width modulation (PWM). The setting is made for this period. Although the shorter period brings about better response, thus improving the controllability, the frequency of ON/OFF operation will increase. The setting, therefore, should be made in consideration of the service life of the operating terminal.
(Since the SSR/SSC-driven output involves no problem of the service life, the setting of 1 second is recommended.)

Example) The operation in the case of MV=60%

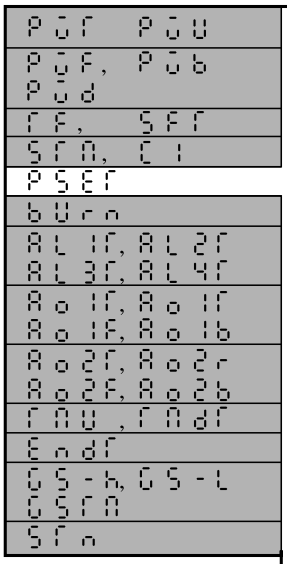


Setting

C 1 Output proportional period

1 to 120 sec.

2.8 Setting of preset MV .... (defining MV in the reset state)



Explanation

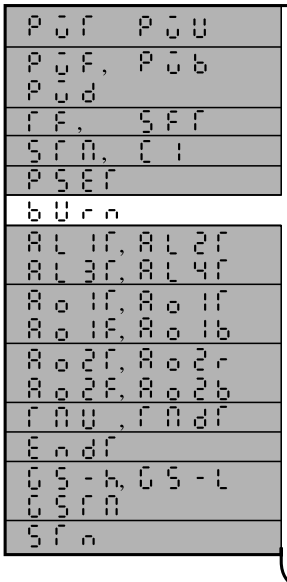
The value of MV is defined in the reset mode.
In the reset mode a value assigned to this parameter is an output as the MV.

Setting

PSEr Preset MV setting

–5.0 to 105.0%

2.9 Burnout MV setting ..... (defining MV at the burnout)



Explanation

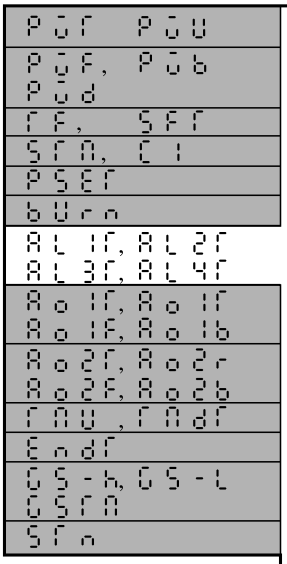
The setting is made for an output value of MV at the time of the input burnout or at a fault state such as the trouble with the unit. Because this being an uncontrollable state, the value should be set so that the processing may be developed into the safe side.

Setting

bUrn MV setting at the burnout

–5.0 to 105.0%

2.10 Setting of alarm type



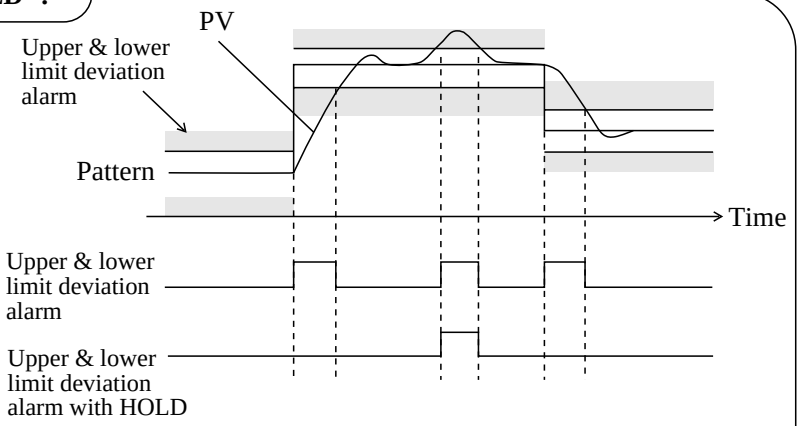
Explanation The type of alarms, 1 to 4, (3 and 4 are optional) is assigned.

Setting AL 1r ~ AL 4r Setting of alarm types 1 to 4

Code	Type	
0	No alarm	No alarm is used.
1	Upper threshold	PV, Alarm set value
2	Lower threshold	PV, Alarm set value
3	Upper deviation	Alarm set value, PV, SV
4	Lower deviation	Alarm set value, PV, SV
5	Upper deviation (Turn-over)	Alarm set value, PV, SV
6	Lower deviation	Alarm set value, PV, SV
7	Upper and lower deviation (Turn-over)	Alarm set value, PV, SV
8	Upper and lower deviation (Turn-over)	Alarm set value, PV, SV
9	Guarantee soak timeout alarm	Where the PV fails to enter the specified range before the maximum wait time is lapsed
10	fault	Where the unit becomes faulty, such as the input burnout
11 to 18	with HOLD for 1 - 8 above	

What is an alarm with "HOLD"?

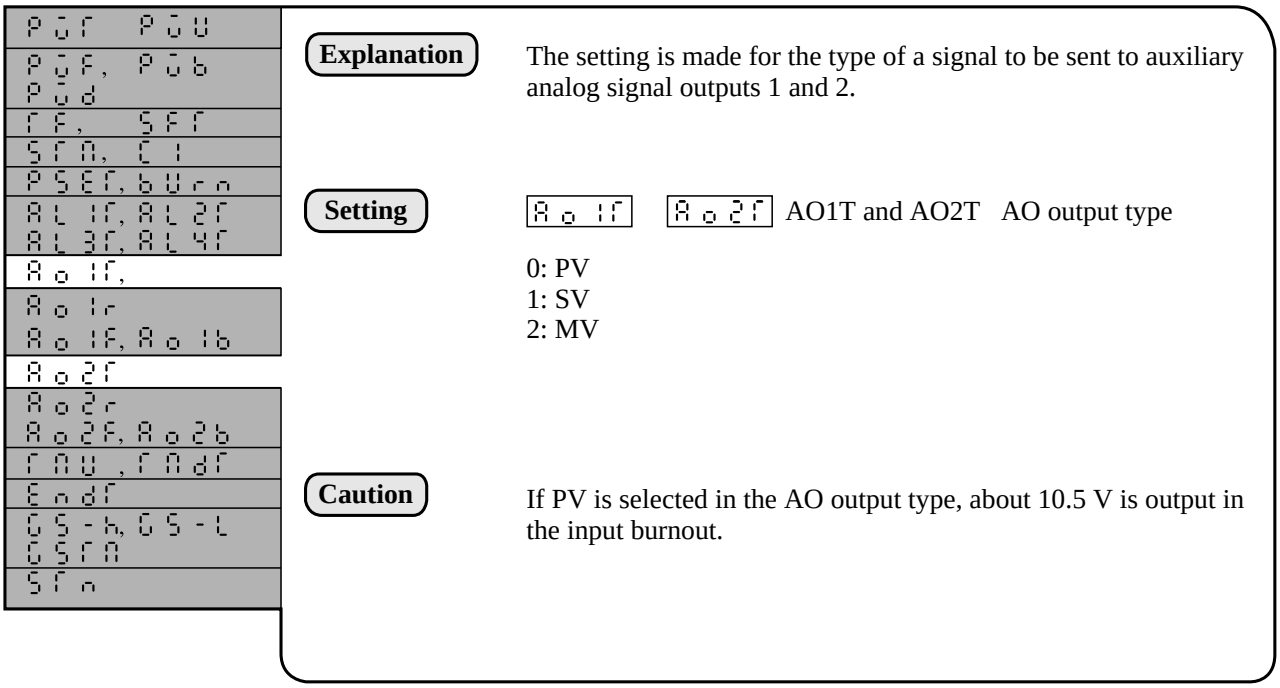
The alarm with "HOLD" is a type of alarm to be generated, where the PV enters an alarming range without causing the alarm ON, letting the PV to leave the alarming range, but again enters the alarming range.
This is an effective function for using a deviation alarm in step-type programming.



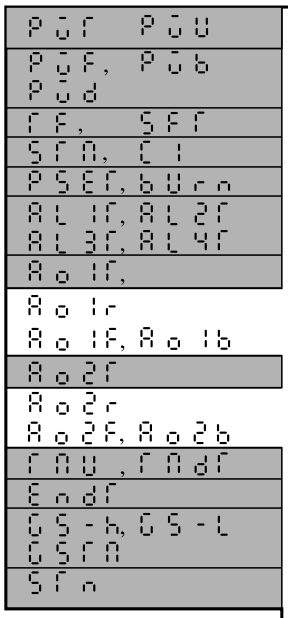
The alarm standby (supervision for alarm OFF and deviation from the range) is performed in the following cases:

- when the alarm set value is changed
- when the alarm type is changed
- when the set value (SV) is changed (however, no standby is performed when the SV is changed in the ramp segment.)

2.11 AO output type ..... (sending PV, SV, and MV to auxiliary analog output)


Explanation
The setting is made for the type of a signal to be sent to auxiliary analog signal outputs 1 and 2.
Setting
Ao1T and AO2T AO output type
0: PV
1: SV
2: MV
Caution
If PV is selected in the AO output type, about 10.5 V is output in the input burnout.

2.12 AO range and scale ..... (scaling auxiliary analog output)



Explanation

The outgoing analog signal for this unit, with 0 to 10 VDC output capability, permits a change in the range and the scaling for the connection with other receiving instruments.

Setting

Ao1r Ao2r AO output range

0: 1 to 5V
1: 0 to 5V
2: 0 to 10V

Ao1F Ao2F AO output full-scale

A desired output value, 100% of the AO output range, is assigned in engineering units.
- When the output type is PV or SV:
  0 to 100% of the input range (in the industrial value notation)
- When the output type is MV:
  0 to 100% (in the percentage notation)

Ao1b Ao2b AO output base scale

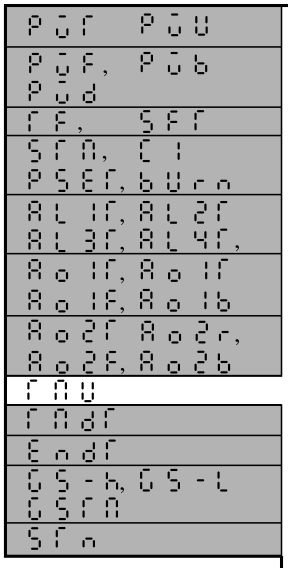
A desired value for 0% output of the AO output range is assigned in the engineering unit notation.
- When the output type is PV or SV:
  0 to 100% of the input range (in engineering units)
- When the output type is MV:
  0 to 100% (in percentages)

Caution

If the input range is 0 to 400 , a set value (SV) of 50 to 350 is output to AO1 on 0 to 5 VDC.

AO1T=1 ····· SV is output.
AO1r=1 ····· An output range of 0 to 5 VDC
AO1F=350 ····· 100% output at 350°C
AO1b=50 ····· 0% output at 50°C

2.13 Time unit ..... (switching from hr:min to min:sec or vice versa)



Explanation

A time unit is set for the time display or for time setting.

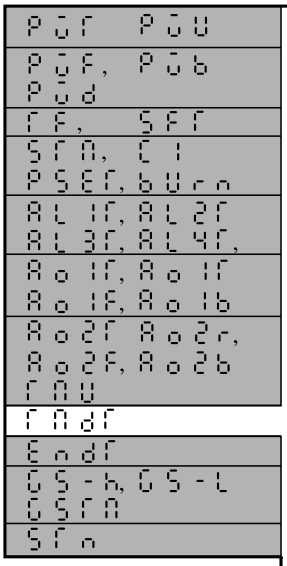
Setting

rMU TMU time unit

0: hr:min

1: min:sec

2.14 Setting of time display type ..... (switching from remaining time to lapsed time or vice versa)



Explanation

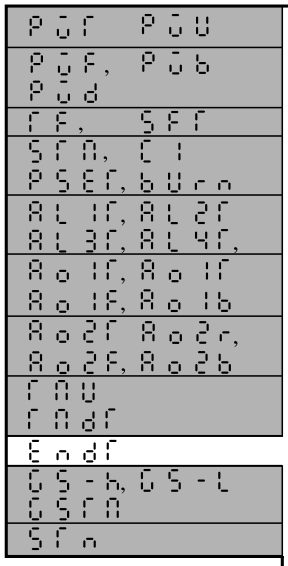
Either "Remaining time indication" or "Lapsed time indication" is set for the time display in the operating screen.

Setting

rMdr TMdT Type of time display

0: Remaining time indication
1: Lapsed time indication

2.15 END signal output time



Explanation

The setting is made for the time of turning on the END signal (optional) in the profile output of this unit at the end of a program.

Setting

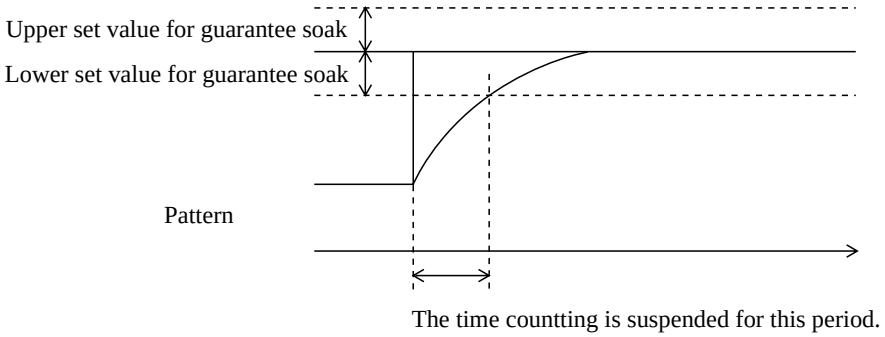
EndT ENDT END signal output time

0.0 to 99.59 hr:min
(min:sec)

2.16 Guarantee soak waiting allowance and setting of max. wait time

Explanation

• Garantee soak wait time allowance
This is the time setting for the resumption of time counting in the guarantee soak.


Upper set value for guarantee soak
Lower set value for guarantee soak
Pattern
The time countting is suspended for this period.

• Max. wait time in the guarantee soak
A function to resume the time counting automatically at the lapse of a predetermined time even if the measured value has not entered the guarantee soak wait time while waiting in the guarantee soak.

Setting

G5-H G5-L Guarantee soak upper & lower threshold values

0 to 50% of the input range (in engineering unit)

G5TM G5TM Max. wait time in guarantee soak

0.0 to 99.59 hr:min (min:sec)

Supplement

This unit is capable of generating an alarm when the time counting is resumed automatically at the lapse of the max. wait time while waiting in the guarantee soak. (See section 3.2 (10) Alarm Type Setting)

2.17 Setting of T-link station number

Explanation

T-link station number is assigned.

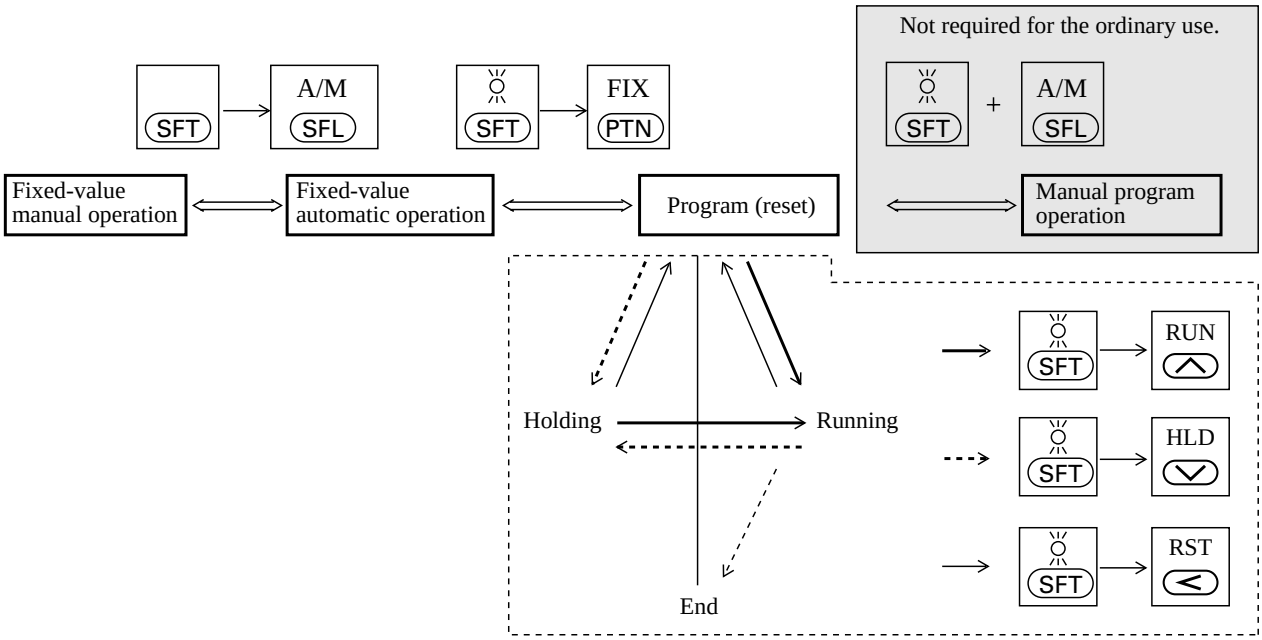
Setting

SFTn STN T-link station number

0 to 99

3. Various Operating Methods

3.1 In this unit the operation mode (operating profile) can be changed over as illustrated below.



• The changeover to the fixed-value automatic mode can be made only from the program reset mode.

Behaviors of SV and MV in various modes

• Program reset mode ····· Stand-by mode in the running of a program
SV ····· SV value in the 1st segment of the current pattern selected
MV ····· Preset MV

• Program (Run, hold, and end) ····· Program running mode
SV ····· According to the program pattern
MV ····· Automatic (calculated value by PID)

• Manual program operation ····· The mode switched from the program mode to the manual operation. In this case, the program will run in its own course. However, the program will keep on running by switching to the manual operation while the program is running.
SV ····· according to the program pattern (running in its own course)
MV ····· MV set value from the keyboard

• Fixed-value automatic operation ····· Fixed-value running mode
SV ·····SV set value from the keyboard. The value would be equal to PV when the program mode is switched to the fixed value mode.
MV ····· Automatic (calculated value by PID)

• Fixed-value manual operation ····· Manual operation mode
SV ····· Before switching to the manual operation
MV ····· MV set value from the keyboard.

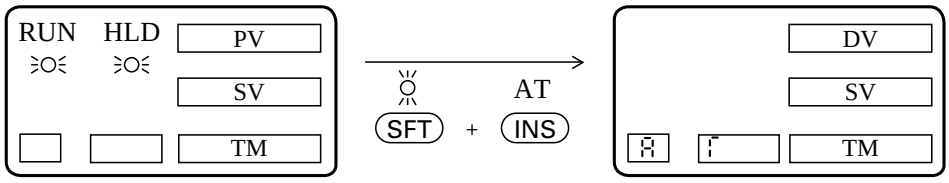
Operation at the changeover of mode

MV ····· Balanceless, bumpless

SV ·····{ Program→ Fixed value ····· PV tracking
Others ····· Continuous or running in its own course

3.2 Auto tuning

In the auto tuning the most common control constants are automatically set.

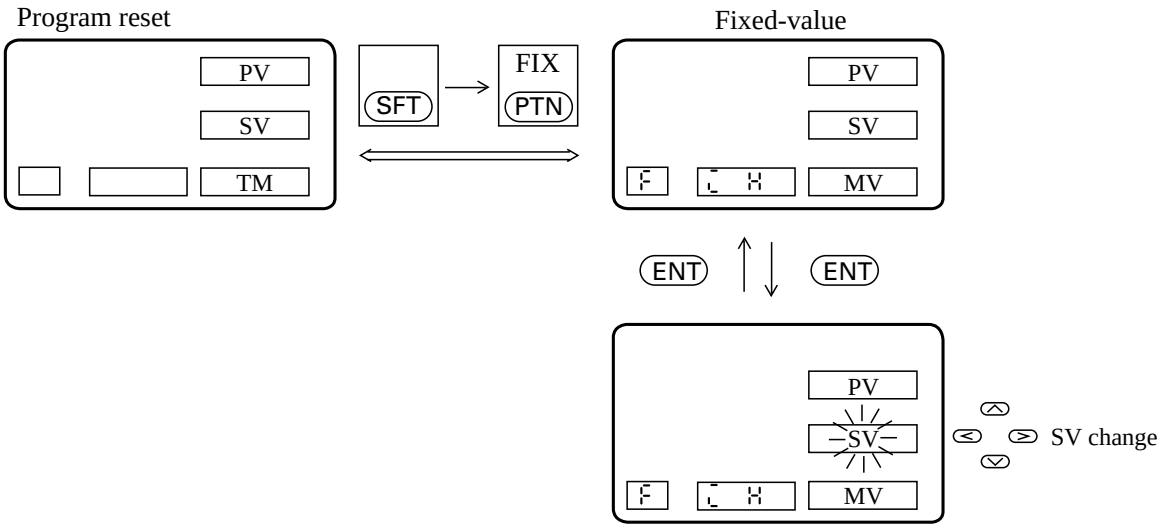


- The auto tuning can be applied when the operating profile is in the fixed value mode, in the program running mode, or in the program holding mode.
- If the auto tuning is applied in the program running mode, the time count will be suspended and the program will stop running.
- However, the program operation will be restarted when the auto tuning is terminated.
- The application of the auto tuning in the neighborhood of an operating SV is recommended under the normal circumstance.

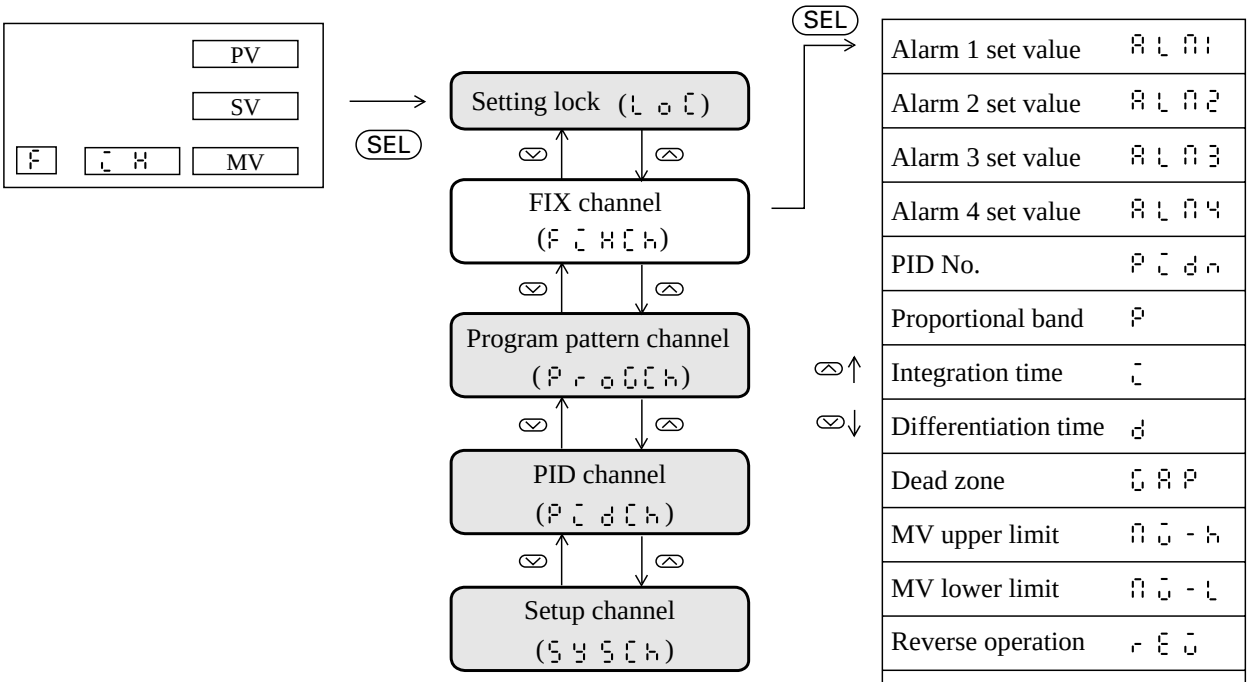
3.3 Fixed value operation

The switching to the fixed value operation is possible only when the program operation is in the reset state.

(The switching to the reset state from the fixed value state, or vice versa, can be accomplished by toggle action.)



In the fixed value operating mode, "Fix Channel" (F C H Ch) will appear in the channel menu.



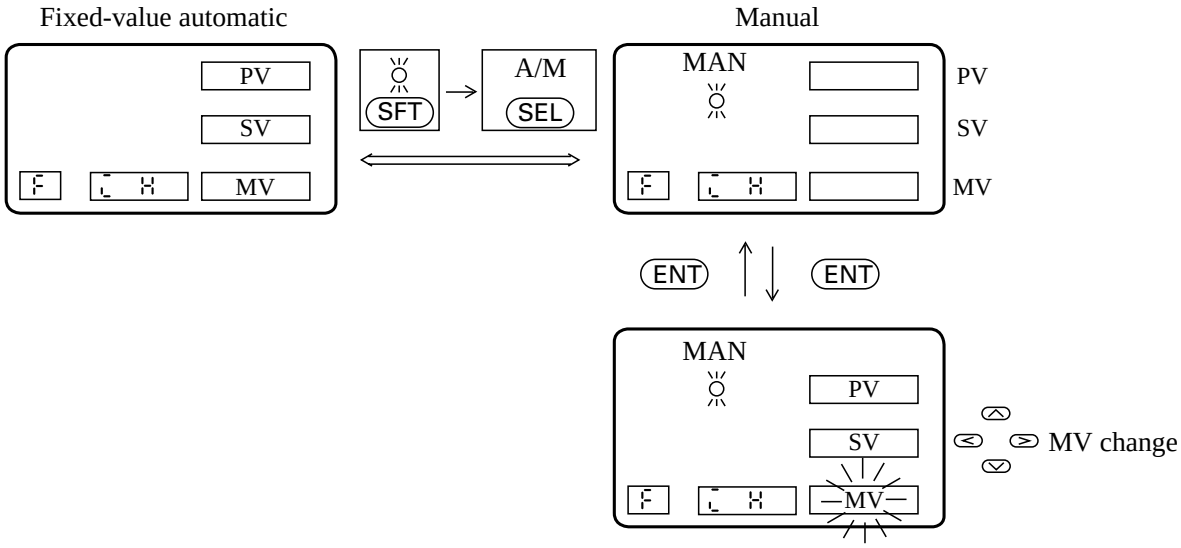
Alarm 1 set value	AL01
Alarm 2 set value	AL02
Alarm 3 set value	AL03
Alarm 4 set value	AL04
PID No.	PIDn
Proportional band	P
Integration time	I
Differentiation time	d
Dead zone	DAP
MV upper limit	OU-H
MV lower limit	OU-L
Reverse operation	rEU
Non-linear gain	tnL
Integration break point	Ar
Manual reset	OAn

Parameters from P (Proportional band) to OAn (Manual reset) can call the PID group set number, 1 to 9, in this area by setting PIDn (PID group number) to any of the numbers 1 to 9 in the same structure as that of the PID channel parameter.

3.4 Manual operation

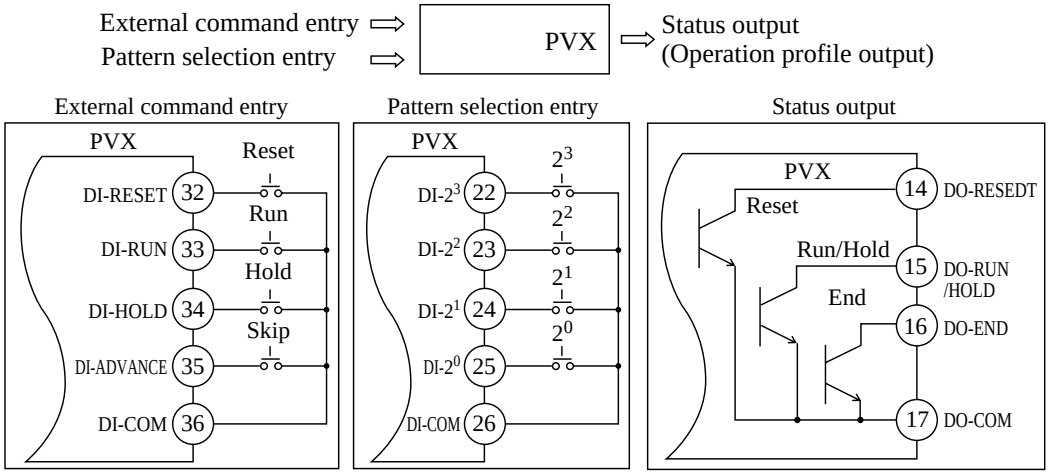
This is an operating mode in which the manipulating value (MV) setting is performed from the front keyboard.

MANUAL ⇐⇒ AUTO switching can be accomplished by toggle action.



3.5 Remote operation (Option).... (for the entry of external commands and selected pattern and the output of status)

This is an optional function available when this unit is used in combined use of some external devices, such as a command switch, digital switch, and sequencer.



(1) External command entry

- A corresponding command is accepted when DI-RESET, DI-RUN, DI-HOLD, or DI-ADVANCE is turned ON for more than 0.5 sec.

- Since a command is accepted at the startup, (OFF → ON), turn OFF for more than 0.5 sec. and then turn ON again if the successive entry of a command such as SKIP is required.

- The concurrent entry of some different commands will be accepted in the following preferential order:

  RESET > RUN > HOLD > SKIP

- The same priority is given to the keyboard entered command and the external DI input command. Therefore, a command accepted later will be validated.

(2) Pattern select entry

A pattern is selected with DI-2^3, DI-2^2, DI-2^1, or DI-2^0, as shown in the table below.

A pattern is selected by continuous DI input for more than 0.5 sec. for the input pattern number.

For the external pattern input and the front pattern select key entry, the following priority is given:

EXTERNAL PATTERN SELECTION > FRONT PATTERN SELECT KEY

The pattern may be selected with the front pattern select key only when the external pattern select entry is '0' (the state in which none of DIs are ON).

Selected pattern	DI-2^3	DI-2^2	DI-2^1	DI-2^0
Pattern selected from keyboard	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	ON
2	OFF	OFF	ON	OFF
3	OFF	OFF	ON	ON
4	OFF	ON	OFF	OFF
5	OFF	ON	OFF	ON
6	OFF	ON	ON	OFF
7	OFF	ON	ON	ON
8	ON	OFF	OFF	OFF
9	ON	OFF	OFF	ON

Pattern Number = 9 is selected where the combination with DI-2^0 through DI-2^3 is other than the above.

(3) Status output (Operating profile output)

This is a function to output an operating profile of this unit.Use this function as an ACKNOWLEDGE signal when linking with the sequencer.

DO-RESET: Turns ON in the reset state.

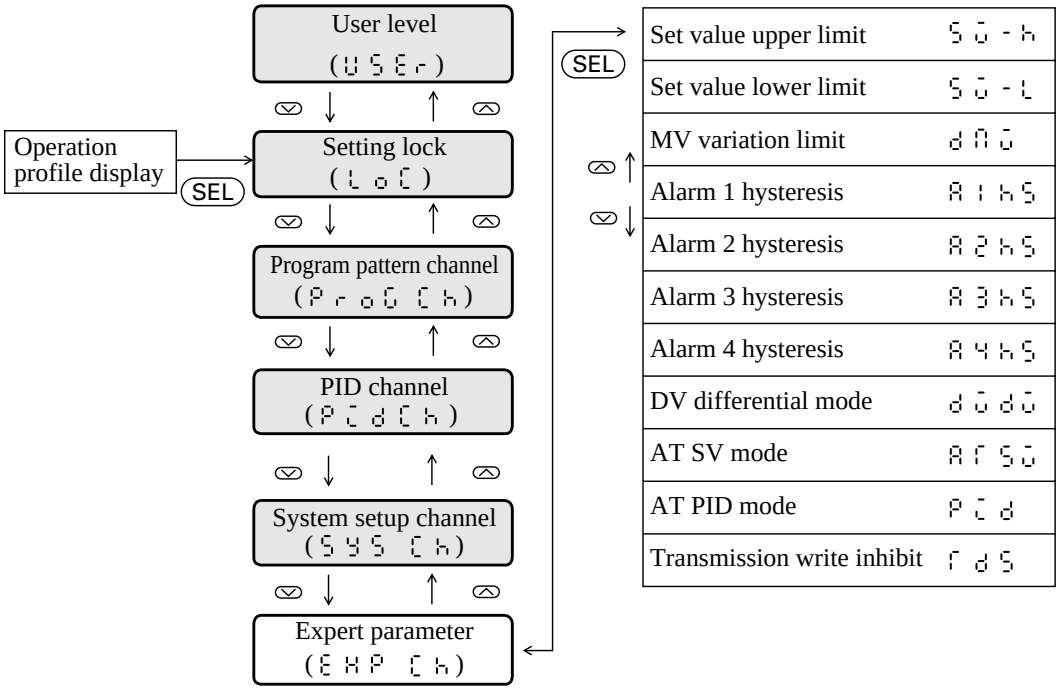
DO-RUN/HOLD: { ON: Running state / OFF: Holding state

DO-END: Turns ON at the end of a program during the time set for [End] signal output time.

SECTION 4 ADVANCED USAGE

This section describes the PVX expert parameters. Those who want to make full use of this unit or to explore a new type of the usage are requested to read this section.

1 Structure of expert parameter channel

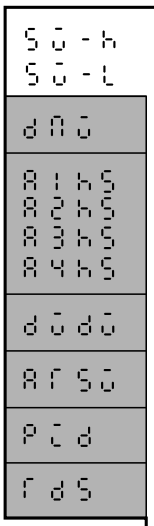


The expert parameter channel is displayed only when the user level is '2' (Expert).

Code	Name		Setting range	Notation	Remarks
SU-H	SV-H	Set value upper limit	0 to 100% of the input range	Engineering units	
SU-L	SV-L	Set value lower limit	0 to 100% of the input range	Engineering units	
dMU	DMV	MV variation limit	0.0 to 105.0	%	
A1HS	A1HS	Alarm 1 hysteresis width setting	0 to 50% of the input range	Engineering units	
A2HS	A2HS	Alarm 2 hysteresis width setting	0 to 50% of the input range	Engineering units	
A3HS	A3HS	Alarm 3 hysteresis width setting	0 to 50% of the input range	Engineering units	To be displayed only when alarms 3 and 4 are provided.
A4HS	A4HS	Alarm 4 hysteresis width setting	0 to 50% of the input range	Engineering units	
dUdU	DVDV	DV defferential specification	YES : DV differentiation no : PV differentiation		
ArSU	ATSV	AT SV mode	0: Standard 1: Low PV type		
PId	PID	AT PID tuning specification	0: PI tuning 1: PID tuning		
rdS	TDS	Transmission write inhibit	YES : Write inhibit no : Write enable		

2 Setting of each parameter

2.1 Set value (SV) upper and lower limits



Explanation

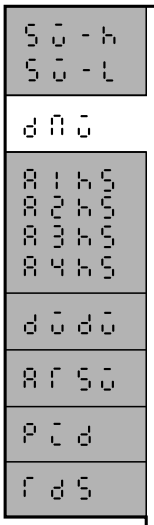
The range of a set value (SV) is limited with an upper limit and a lower limit. As a result, a value may be set within the limited range when the set value is changed from the keyboard or through the transmission.

Setting

SV-H	Set value (SV) upper limit
SV-L	Set value (SV) lower limit

0 to 100% of the input range
(Engineering units)

2.2 Manipulating value (MV) variation limit



Explanation

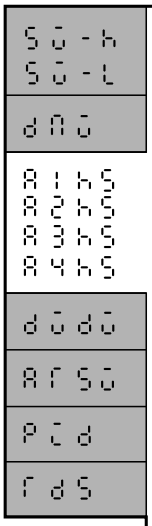
The restriction is placed on a variation fo the MV in the automatic operation (the state in which the PID control is performed).
This unit performs the control operation at a time interval of 0.1 second.
A variation of the manipulating value (MV) for 0.1 second is limited by the parameter set value. This is effective for a process in bubbles or in a process avoiding an abrupt change in the MV.

Setting

dNU	MV variation limit

0 to 105.0% (in percentages)

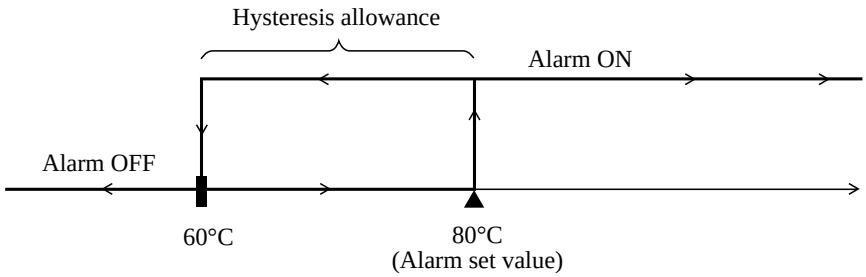
2.3 Setting of alarm 1 to 4 hysteresis allowances



Explanation

The hysteresis is to provide an allowance for the alarm ON and OFF operating points. Normally, the hysteresis is used for the prevention of chattering (disorder of alarm). Also it is used for positively shifting the ON and OFF operating points.

Example) Where a hysteresis allowance of 20°C is provided for an upper limit absolute alarm with the alarm set value of 80°C:



When PV is rising : the alarm turns ON at 80°C.
When PV is falling: the alarm turns OFF at 60°C.

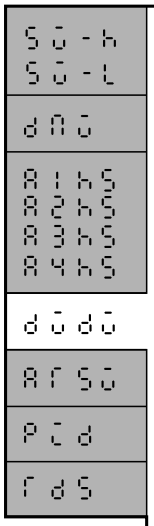
Setting

A1HS	Alarm 1 hysteresis allowance setting
A2HS	Alarm 2 hysteresis allowance setting
A3HS	Alarm 3 hysteresis allowance setting
A4HS	Alarm 4 hysteresis allowance setting

0 to 50% of the input range (engineering units)

If the alarm type is deviation alarm, the setting must be made so that the alarm set value is greater than the hysteresis allowance.

2.4 DV differentiate specification..... D operation of PID is differentiated for DV.



Explanation

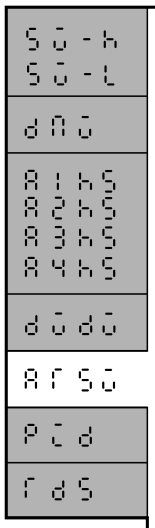
The D action in the PID operation is differentiated for DV. The standard D action in this unit is the PV differentiation (differentiation-preceding type PID). The controllability may be improved by specifying the DV differentiation when the ramp pattern is used.

Setting

dUdU DV differentiate specification

YES : DV differentiation
no : PV differentiation (standard)

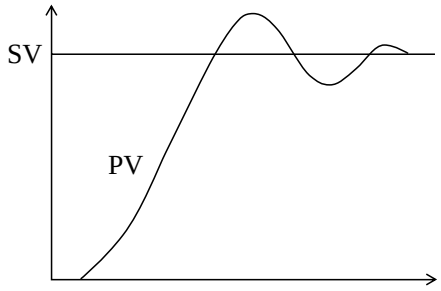
2.5 AT SV mode ..... Auto tuning in the low PV type



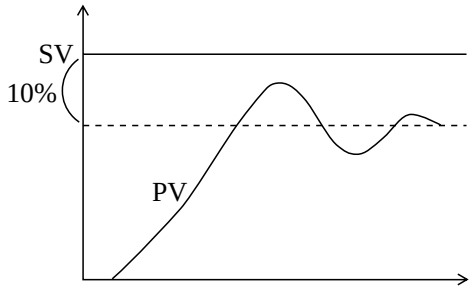
Explanation

Auto tuning for this unit is performed by Limit Cycle method, centering on a set value (SV). In the low PV type auto tuning, the central point is lowered by 10%. This 10%-lower PV type is used even in the auto tuning, where the measured value (PV) should be less than the set value (SV).

(Standard AT)



(Lower-PV type AT)

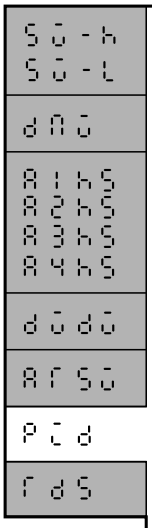


Setting

ArSU AT SV mode

0: Standard AT (standard)
1: Low-PV type AT

2.6 AT PID mode ..... Obtaining PI control parameter



Explanation

The AT PID mode is used to obtain a parameter for the PI control in the auto tuning. However, the auto tuning in the standard status of this unit will seek a parameter for the PID control.

Setting

PId AT PID mode

0: Parameter for PI control is obtained.
1: Parameter for PID control is obtained. (standard)

2.7 Transmission write Protect ..... The SV change via transmission is inhibited.

SV-H
SV-L
dAU
A1HS
A2HS
A3HS
A4HS
dUdU
ArSU
PId
rdS

Explanation

A change of the set value (SV) via transmission is inhibited. (The inhibition of a set value change from the keyboard can be accomplished with the setting lock (LoC) parameter.)

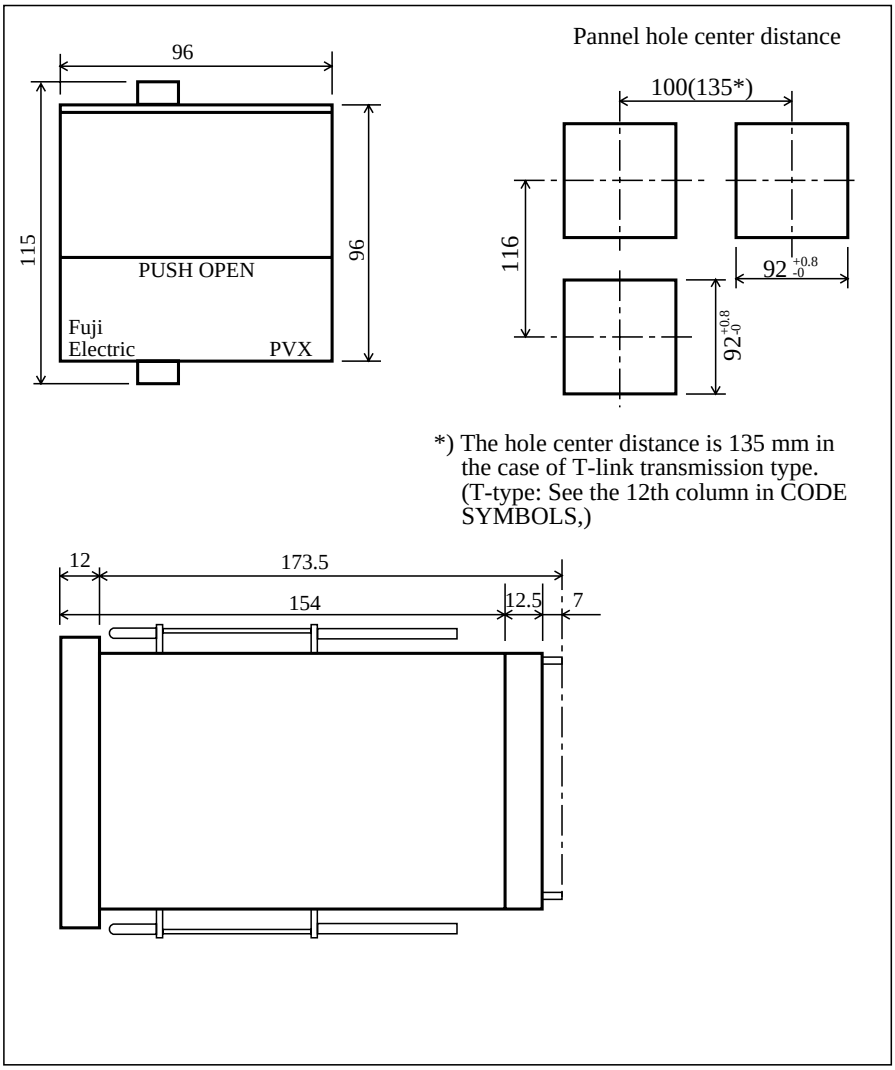
Setting

rdS	Transmission write Protect

0: A change of SV via transmission is allowed. (standard)
1: A change of SV via transmission is inhibited.

SECTION 5 INSTALLATION AND WIRING

1 Outline Diagrams



2 Installation

2.1 Appropriate locations for installation

Like ordinary electronic digital devices, the unit should be installed at a location where the following requirements are fulfilled:

(1) The temperature is within the normal range, 0°C to 50°C, with small changes.
(2) The area is free from corrosive gases (sulfide gas and ammonia gas, in particular).
(3) The area is free from an excessively low or high humidity. (10 to 90 RH)
(4) The area is subject to very small mechanical vibration.(2 m/s^2 or less. 10 to 60 Hz)
(5) The area is subject to very small amount of dust and soot.
(6) The area is less affected by electrical noise.
(7) The area is free from intensive magnetism.

2.2 How to install the unit

(1) Install the unit with the rear part descending at 15 degrees or less.
(2) For the pannel, use 2mm thick steel plate.
(3) Insert the unit casing into the pannel hole.
(4) Use fixtures (attachments) to secure the upper and lower part of the unit.

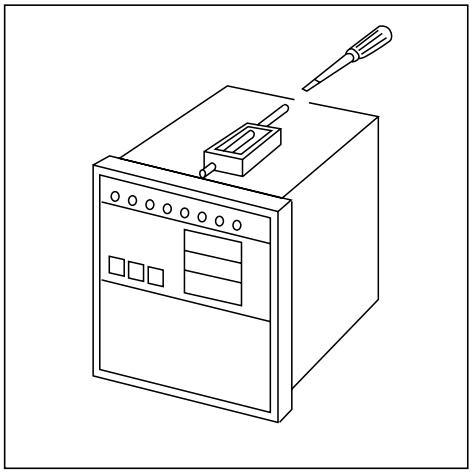


Figure 5-1 How to install

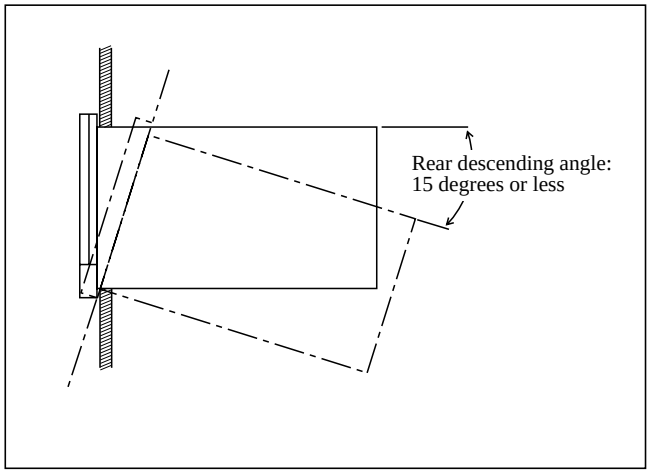


Figure 5-2 Installation angle

3 Wiring

3.1 Cautions for wiring

- Install a power switch and fuses as required. (Rating of fuse: 250V, 1A)The power switch and fuses are not provided for the unit.
- Use a specified compensation lead wire for connecting with the input thermocouple.
- For the resistance bulb input wire, select a lead wire with small resistance.
- To avoid the influence of induced noise on the cable connecting the input signal line, power supply line, and the blind controller, the cable must be laid apart from the power supply line and load lines.
- The input signal line and the output signal line must be separated from each other, using shielded wires.

3.2 Noise control measures

- The measures, as listed below, should be taken where the external wiring is subject to excessive noise.
  If a contactor is connected as a load of the digital output such as the relay contact output and the alarm output, additionally install a surge absorber to the contactor coil. Z-TRAP (Specification: 220V AC, ENB461D-14A, manufactured by Fuji Electric)

- Where excessive noise is generated from the power supply, the additional installation of an insulating transformer and the use of a noise filter are suggested.
  (Example: Noise filter, ZMB22R5-11, manufactured by TDK)

- Twisting wiring is effective for the power supply line of instruments.

3.3 For connection of load circuit

Use an additional auxiliary relay, since the operating life of the output relay will be shortened with a full load, where the relay operation is frequently performed as in the proportional operation.
In this case, the use of SSR or SSC-drive output type is recommended.
For an electromagnetic switch: a proportional period of 30 seconds or longer
For SSC or SSR : a proportional period of 1 second is a target value.
Contact output life span: Mechanical life of 30 million times or more (under no load)
Electrical life of 100 thousand times or more (at rated load)

3.4 Wiring for the input 1 to 5 VDC

Although 250-ohm resistors are supplied as an attachment in the input specification of 4 to 20mA DC, these resistors will not be required.

3.5 External wiring diagram

An external wiring diagram is shown in Figure 5-3.

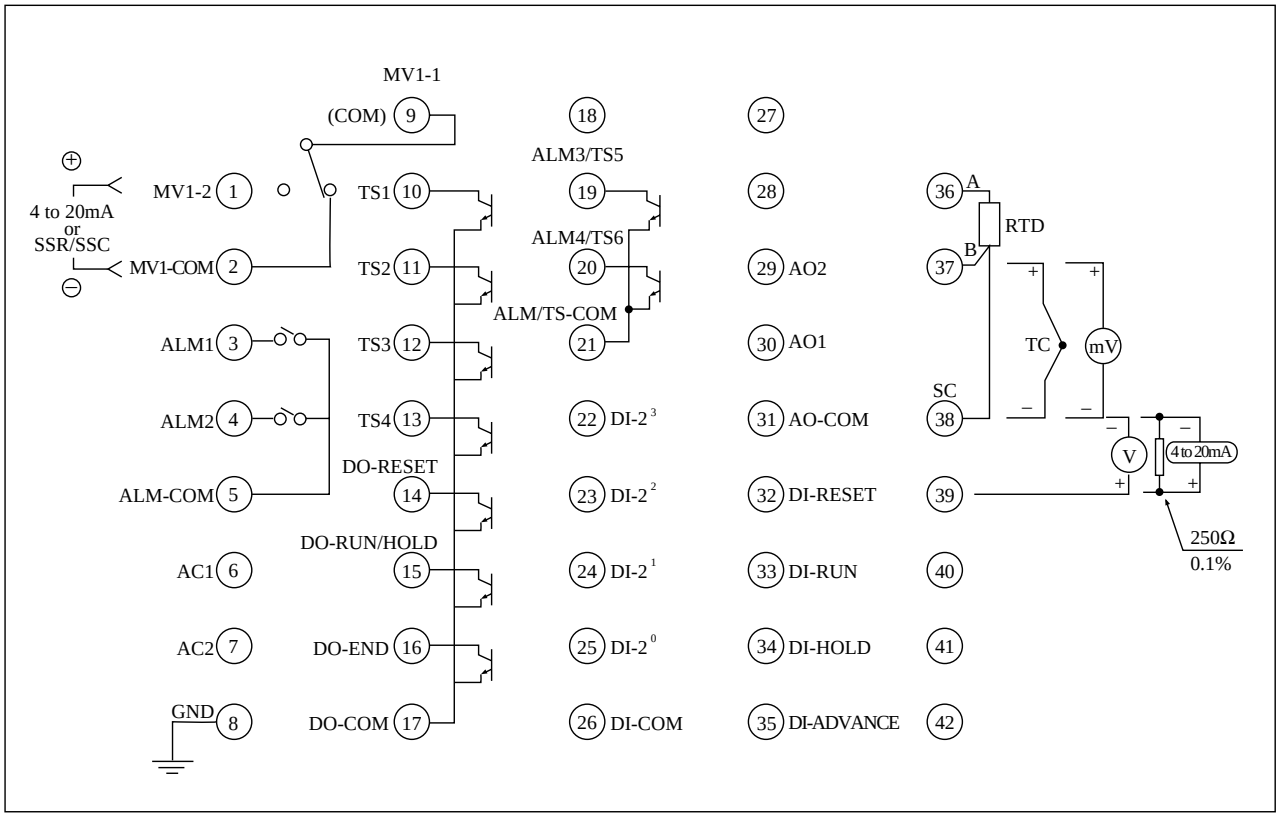


Figure 5-3 External Wiring Diagram

SECTION 6 APPENDIX

1. Specifications

1.1 Input Section

(1) Input signal-manipulating range .. Multi-range mode

Range code setting mode is employed for the thermocouple and resistance bulb inputs.(See Table 1)

Programmable scale mode is employed for DC voltage and current inputs. (See Table 1)

(2) Specification and setting accuracy

- Thermocouple input, resistance bulb input, and voltage input

  ±0.2% FS±1 digit (at 23°C)

  where, B thermocouple 0 to 400°C±5%

  R thermocouple 0 to 500°C±1%

- Current input

  ±0.5% FS±1 digit (at 23°C)

  or ±0.3% FS±1 digit (when using high-precision resistor)

(3) Temperature drift

- ±0.2% FS/10°C

(4) Indicating resolution

- Thermocouple input: 1°C or 0.1°C
- Resistance bulb input: 1°C or 0.1°C

(5) Cold junction compensation error

- ±1.0°C

(6) Input sampling period

- 100 msec

(7) Input impedance

- Thermocouple: 1 mega ohms or more
- Current input: Outside resistor 250 ohms
- Voltage input: 1 mega ohms or more

(8) Permissible signal source resistance

- Thermocouple: 250 ohms or less
- Voltage input: 1 k ohms or less

(9) Permissible wire resistance

- Resistance bulb : 10 ohms or less (per wire)

(10) Permissible input voltage

- Voltage input : within ±35 V
- Current input : within ±22 mA
- Other inputs : within ±13 V

(11) Noise elimination ratio

- Normal mode: 60 dB (50/60 Hz)
- Common mode : ±1°C on 220V AC to ground, at 50/60 Hz
  ±1°C on 220V AC between input and output, at 50/60 Hz

(12) Digital filter

- First-order lag filter
- 0.0 to 120.0 seconds, resolution: 0.1 second (0 : OFF)

(13) PV input correction

- ±50.0%

(14) Over-range and under-range

- To detectable outside the range of from –5% to 105% of FS

1.2 Output part

(1) Control output

- Relay contact output

  Proportional period: 1 to 120 sec.

  Contact capacity: 220V AC/30V DC, 3A (resistive load)
  220V AC/30V DC, 1A (inductive load)

  Min. switching current: 100mA (24V DC)

  Mechanical life: 30 million times (100 times/min)

  Electrical life: 100 thousand times (rated load)

- Voltage pulse output (SSR/SSC-drive output)

  Proportional period: 1 to 120 sec.

  ON voltage: 10V DC to 18V DC

  OFF voltage: 0.5V DC or less

  Max. current: 20 mA DC

- Current output (4 to 20mA DC)

  Guaranty output range: 3.2mA DC to 20.8mA DC (–5 to 105%)

  Accuracy: ±2% FS

  Linearity: ±2% FS

  Resolution: ±0.1% FS

  Follow-up speed: 0.1 sec. or less

  Ripple current: P-P 0.2% FS or less (50 Hz or less)

  Load resistance: 600 ohms or less

(2) Auxiliary analog output (Option)

- Number of points: 2 points max. (option)
- Output type: 0 to 10 V DC

  Guaranty output range: 0V DC to 10.5 V DC (0 to 105%)

  Accuracy: ±0.08% FS

  Ripple voltage: P-P 0.08% FS or less (50 Hz or less)

  Temperature drift: ±0.08% FS/10°C

  Load resistance: 500 k ohms or more

- Supplementary function: Scaling function available
- Output update interval: 100 msec.

cf. An accuracy of ±0.2% FS can be assured when scaling 1 to 5 V DC output.

1.3 Digital input (Option)

16 V DC, 15 mA

Threshold voltage: 6 V min. 15 V max.

Input read interval: (a pulse input of 0.5 sec. or longer)

(1) External command input (4 points)

- RESET Program reset
- RUN Program run to start
- HOLD Program run to hold
- ADVANCE Advancing a segment

(2) Pattern select input (4 points)

- BCD input - 1 digit (2^3, 2^2, 2^1, and 2^0)

1.4 Digital output

- Output update interval : 100 msec.

(1) Alarm output (ALM1 and ALM2) (Standard)

- Relay output × 2 points 1a contact

Contact capacity: 220 V AC/30 V DC, 1 A (resistive load)
220 V AC/30 V DC, 0.3 A (inductive load)

Min. switching current: 100 mA(24 V DC)

Mechanical life : 12 million times (20 times/min)

Electrical life: 60 thousand times (rated load, 20 times/min)

(2) Expanded alarm output (ALM3 and ALM4) (Option)

- Open collector output × 2 points
- 24 V DC, 50 mA or less

(3) Time signal (TS1, TS2, TS3, and TS4) (Option)

- Open collector output × 4 points
- 24 V DC, 50 mA or less

(4) Expanded time signal (TS5 and TS6) (Option)

- Open collector output × 2 points
- 24 V DC, 50 mA or less

(5) Status signal output (Option)

- Open collector output × 3 points
- 24 V DC, 50 mA or less

RESET Reset state

RUN/HOLD Program running/holding state

END Program ending state

1.5 Communication facility (Option)

Not provided

1.6 Display section

(1) Display mode
- 7-segment, 4-digit × 3, red and green LED
- LED, red and green

(2) Display character
- 7.62 mm high and 4.19 mm wide

(3) Display update interval 100 msec

1.7 Keyboard section

(1) Key switch
- 10 sets

(2) Function
- Parameter setting and the unit operation

1.8 Setting resolution

- Thermocouple inpu: 1°C or 0.1°C (1°F or 0.1°F)
- Resistance bulb input: 1°C or 0.1°C (1°F or 0.1°F)

1.9 Controllability

Basic PID type (speed type)

(1) Proportional band (P)
- 0.0 to 999.9, 2-position operation with P=0

(2) Integration time
- 0 to 3200 sec., I-operation breaks with I=0

(3) Differentiation time
- 0 to 900 sec., D-operation breaks with D=0

1.10 Program storage capacity

(1) Number of program patterns
- 9 patterns

(2) No. of segments in a pattern
- 20 segments

(3) Multimemory (PID grouping)
- Nine

(4) Number of program repetitions
- 99 times max.

(5) Memory backup: Lithium cell
- Room temperature 0 to 40°C, unused state: 5 years or longer
- Room temperature 40°C or higher, unused state: 1 year or longer

1.11 Power supply

(1) Power voltage
- 100 V AC to 240 V AC, free power supply

(2) Power voltage fluctuation
- Within the range of from +10% to –15%

(3) Power frequency
- 50/60 Hz

(4) Power consumption
- For 100 V AC: 20 VA or less
- For 220 V AC: 30 VA or less

1.12 Normal operating conditions

(1) Room temperature
- 0 to 50°C

(2) Environmental humidity
- 90% RH or less (No condensation must be produced)

(3) Installation profile
- To be installed with the rear end descending at 15 degrees or less

(4) Vibration
- 10 to 70 Hz, 9.8 m/s² or less

(5) Impact
- 29.4 m/s² or less

(6) Warm-up
- 30 min. or longer

(7) Insulating resistance
- Power terminal - Grounding terminal
- Input terminal - Grounding terminal
- Output terminal - Grounding terminal
- Contact terminal - Grounding terminal
- Input terminal - Power terminal
- Output terminal - Power terminal
- Contact terminal - Power terminal
- Output terminal - Input terminal
- Contact terminal - Input terminal
- Contact terminal - Output terminal

} 500 V DC, 20 M ohms or more

(8) Dielectric strength
- Power voltage - Grounding terminal : 1500 V AC, for 1 min.
- Input terminal - Grounding terminal
- Output terminal - Grounding terminal
- Contact terminal - Grounding terminal
- Input terminal - Power terminal
- Output terminal - Power terminal
- Contact terminal - Power terminal
- Output terminal - Input terminal
- Contact terminal - Input terminal
- Contact terminal - Output terminal

} 500 V AC, for 1 min. Leak current: 1.5 mA or less

1.13 Transport and storage conditions (in packed state)

(1) Storage temperature
- –10 to 60°C

(2) Environmental humidity
- 90% RH or less (No condensation must be produced)

(3) Vibration
- 10 to 70 Hz, 19.6 m/s² or less

(4) Impact
- 294 m/s² or less

1.14 Structure

(1) Material
- Plastic housing (ABS-M-GG)

(2) Fire retardancy
- UL94V-0 or equivalent

(3) Color
- Munsell value : N1.5 (black) or equivalent

(4) Outline dimensions
- (W × H × D) mm: 96 × 96 × 170

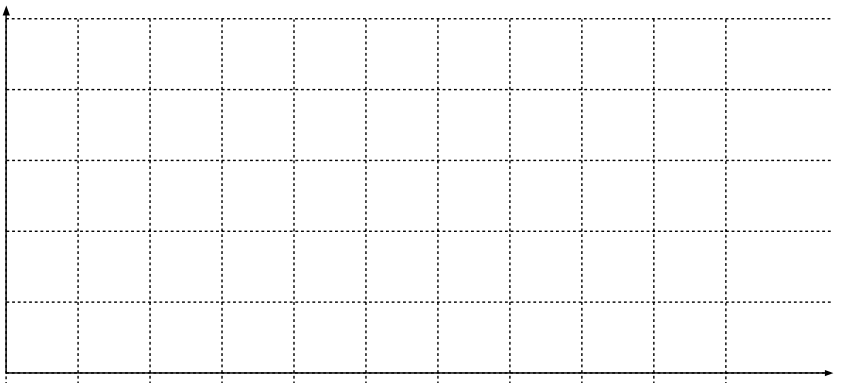
(5) Net Weight
- Approximately 1 kg.

(6) Installation mode
- Insertion into panel hole

(7) External terminals
- Screwed terminal M3.5

(8) Dust-proof cover
- PMMA-M-GE (Transparent with no color) (Option)

2. [Program Pattern Preparation Form]



[Programming map]

Segment					1/11	2/12	3/13	4/14	5/15	6/16	7/17	8/18	9/19	10/20
		Display	Setting range	Notation										
Pattern	Set value	Set value	0 to 10000	Engineering units										
	Time	Time	0.0 to 99.59	hr:min, min:sec										
PID number		PIdn	1 to 9	No.										
Alarm 1 set value		AL n1	0 to 10000	Alarm value										
Alarm 2 set value		AL n2	0 to 10000	Alarm value										
Alarm 3 set value		AL n3	0 to 10000	Alarm value										
Alarm 4 set value		AL n4	0 to 10000	Alarm value										
Time signal 1 ON time		r 1on	0.0 to 99.59	hr:min, min:sec										
Time signal 1 OFF time		r 1oF	0.0 to 99.59	hr:min, min:sec										
Time signal 2 ON time		r 2on	0.0 to 99.59	hr:min, min:sec										
Time signal 2 OFF time		r 2oF	0.0 to 99.59	hr:min, min:sec										
Time signal 3 ON time		r 3on	0.0 to 99.59	hr:min, min:sec										
Time signal 3 OFF time		r 3oF	0.0 to 99.59	hr:min, min:sec										
Time signal 4 ON time		r 4on	0.0 to 99.59	hr:min, min:sec										
Time signal 4 OFF time		r 4oF	0.0 to 99.59	hr:min, min:sec										
Time signal 5 ON time		r 5on	0.0 to 99.59	hr:min, min:sec										
Time signal 5 OFF time		r 5oF	0.0 to 99.59	hr:min, min:sec										
Time signal 6 ON time		r 6on	0.0 to 99.59	hr:min, min:sec										
Time signal 6 OFF time		r 6oF	0.0 to 99.59	hr:min, min:sec										
Guarantee soak Yes/No		GS	YES/no	YES/NO										
Guarantee soak type		GSTP	0: Upper and lower 1: Lower 2: Upper											
PV start		PVST	YES/no	YES/NO										
Number of times of cyclic operation		CYCL	oFF, 1 to 99	OFF or 1 to 99										
Link pattern number		LInk	oFF, 1 to 9	OFF or 1 to 99										

3. Paremeter List

Channel	Code	Name		Setting Range	Notation	Initial value	Remarks
ProG Ch		SV	Set value	0-100% of input range	Engineering unit	– – – –	
		TM	Segment time	0.00~99.59	hr:min (min:sec)	– – – –	
	PIdn	PID	PID group number	1-9	Number	1	
	AL01	ALM1	Alarm 1 set value	0-100% of input range	Alarm display 1	– – – –	
	AL02	ALM2	Alarm 2 set value	0-100% of input range	Alarm display 2	– – – –	
	AL03	ALM3	Alarm 3 set value	0-100% of input range	Alarm display 3	– – – –	
	AL04	ALM4	Alarm 4 set value	0-100% of input range	Alarm display 4	– – – –	
	T1on	T1ON	Time signal 1 ON Time	0.00~99.59	hr:min (min:sec)	– – – –	
	T1oF	T1OF	Time signal 1 OFF Time	0.00~99.59	hr:min (min:sec)	– – – –	
	T2on	T2ON	Time signal 2 ON Time	0.00~99.59	hr:min (min:sec)	– – – –	
	T2oF	T2OF	Time signal 2 OFF Time	0.00~99.59	hr:min (min:sec)	– – – –	
	T3on	T3ON	Time signal 3 ON Time	0.00~99.59	hr:min (min:sec)	– – – –	
	T3oF	T3OF	Time signal 3 OFF Time	0.00~99.59	hr:min (min:sec)	– – – –	
	T4on	T4ON	Time signal 4 ON Time	0.00~99.59	hr:min (min:sec)	– – – –	
	T4oF	T4OF	Time signal 4 OFF Time	0.00~99.59	hr:min (min:sec)	– – – –	
	T5on	T5ON	Time signal 5 ON Time	0.00~99.59	hr:min (min:sec)	– – – –	
	T5oF	T5OF	Time signal 5 OFF Time	0.00~99.59	hr:min (min:sec)	– – – –	
	T6on	T6ON	Time signal 6 ON Time	0.00~99.59	hr:min (min:sec)	– – – –	
	T6oF	T6OF	Time signal 6 OFF Time	0.00~99.59	hr:min (min:sec)	– – – –	
	GS	GS	Guarantee soak Yes/No	0-1	YES/NO	NO	
	GSTP	GSTP	Guarantee soak Upper/Lower limit	0-2		0	
	PVST	PVST	PV start Yes/No	0-1	YES/NO	NO	
	CYCL	CYCL	Number of cyclic operations	0-99	OFF/numeral	OFF	
	LInk	LINK	Link pattern number	0-19	OFF/numeral	OFF	
Pid Ch	P	P	Proportional band	0.0~999.9	%	8.0%	
	I	I	Integration time	0-32000	Second	240 sec.	
	d	D	Differentation time	0.0-900.0	Second	40 sec.	
	GAP	GAP	Dead zone	0-50% of input range	Engineering unit	0%	
	MV-H	MV-H	MV upper limit	–5.0-105.0	%	105.0%	
	MV-L	MV-L	MV lower limit	–5.0-105.0	%	–5.0%	
	rEV	REV	Reverse specification	0-1	YES/NO	YES	
	tnL	KNL	Non-linear gain	–32767-32767	%	0.0%	
	AR	AR	Integration break point setting	0-100% of input range	Engineering unit	100.0%	
	MAn	MAN	Manual setting	–50.0-50.0	%	0.0%	

Channel	Code	Name		Setting Range	Notation	Initial value	Remarks
SyS Ch	PVT	PVT	PV input type	Input type code table		22	
	PVU	PVU	PV unit	0-1		0	PVT Either one will be displayed depending on PV input type.
	PVF	PVF	PV full scale	–999-9999		1000	
	PVB	PVB	PV base scale	–999-9999		0000	
	PVD	PVD	Decimal point position	0-3		0	
	TF	TF	Filter time constant	0.0-999.0	Second	2.0 sec.	
	SFT	SFT	PV shift	–50.0-50.0% of input range	Engineering unit	0%	
	STM	STM	Start mode	0-1		0	
	C1	C1	Output proportion period	0~120	Second	20 sec	To be displayed on relay drive or SSR drive.
	PSET	PSET	Preset MV value	–5.0-105.0	%	0.0%	
	BURN	BURN	Output set value at burnout	–5.0-105.0	%	0.0%	
	AL1T	AL1T	Alarm 1 type	0-18		1	To be displayed if expanded alarms (3,4) are provided.
	AL2T	AL2T	Alarm 2 type	0-18		2	
	AL3T	AL3T	Alarm 3 type	0-18		3	
	AL4T	AL4T	Alarm 4 type	0-18		4	
	AO1T	AO1T	AO1 output type	0-2		0	To be displayed if auxiliary signal output is provided.
	AO1R	AO1R	AO1 output range type	0-2		0	
	AO1F	AO1F	AO1 full scale	0.0-100.0	%	100.0%	
	AO1B	AO1B	AO1 base scale	0.0-100.0	%	0.0%	
	AO2T	AO2T	AO2 output type	0-2		1	To be displayed if 2 points of auxiliary signal output are provided.
	AO2R	AO2R	AO2 output range type	0-2		0	
	AO2F	AO2F	AO2 full scale	0.0-100.0	%	100.0%	
	AO2B	AO2B	AO2 base scale	0.0-100.0	%	0.0%	
	TMU	TMU	Time unit	0-1		0	
	TMDT	TMDT	Time display type	0-1		0	
	ENDT	ENDT	END signal output time	0.00~99.59	hr:min (min:sec)	0:00	TMU Display format is either "hr:min" or "min:sec" depending on time unit setting.
	GS-H	GS-H	Guarantee soak upper limit set value	–50.0-50.0% of input range	Engineering unit	5%	
	GS-L	GS-L	Guarantee soak lower limit set value	–50.0-50.0% of input range	Engineering unit	5%	
	GSTM	GSTM	Guarantee soak max. wait time	0.00~99.59	hr:min (min:sec)	99:59	TMU Display format is either "hr:min" or "min:sec" depending on time unit setting.
	STN	STN	Station number	0-99		0	To be displayed if T-link transmission is provided.
EXP Ch	SV-H	SV-H	Set value upper limit	0-100% of input range	Engineering unit	100%	
	SV-L	SV-L	Set value lower limit	0-100% of input range	Engineering unit	0%	
	DMV	DMV	MV variation limit	–5.0-105.0	%	105.0%	
	A1HS	A1HS	Alarm 1 hysteresis	0-50% of input range	Engineering unit	0.5%	
	A2HS	A2HS	Alarm 2 hysteresis	0-50% of input range	Engineering unit	0.5%	
	A3HS	A3HS	Alarm 3 hysteresis	0-50% of input range	Engineering unit	0.5%	To be displayed if alarms 3 and 4 are provided.
	A4HS	A4HS	Alarm 4 hysteresis	0-50% of input range	Engineering unit	0.5%	
	DVDV	DVDV	DV differentiate specification	0-1	YES/NO	NO	
	ATSV	ATSV	AT SV mode	0-1		0	
	PID	PID	AT PID specification	0-1		1	
	TDS	TDS	Transmission write disable	0-1	YES/NO	NO	

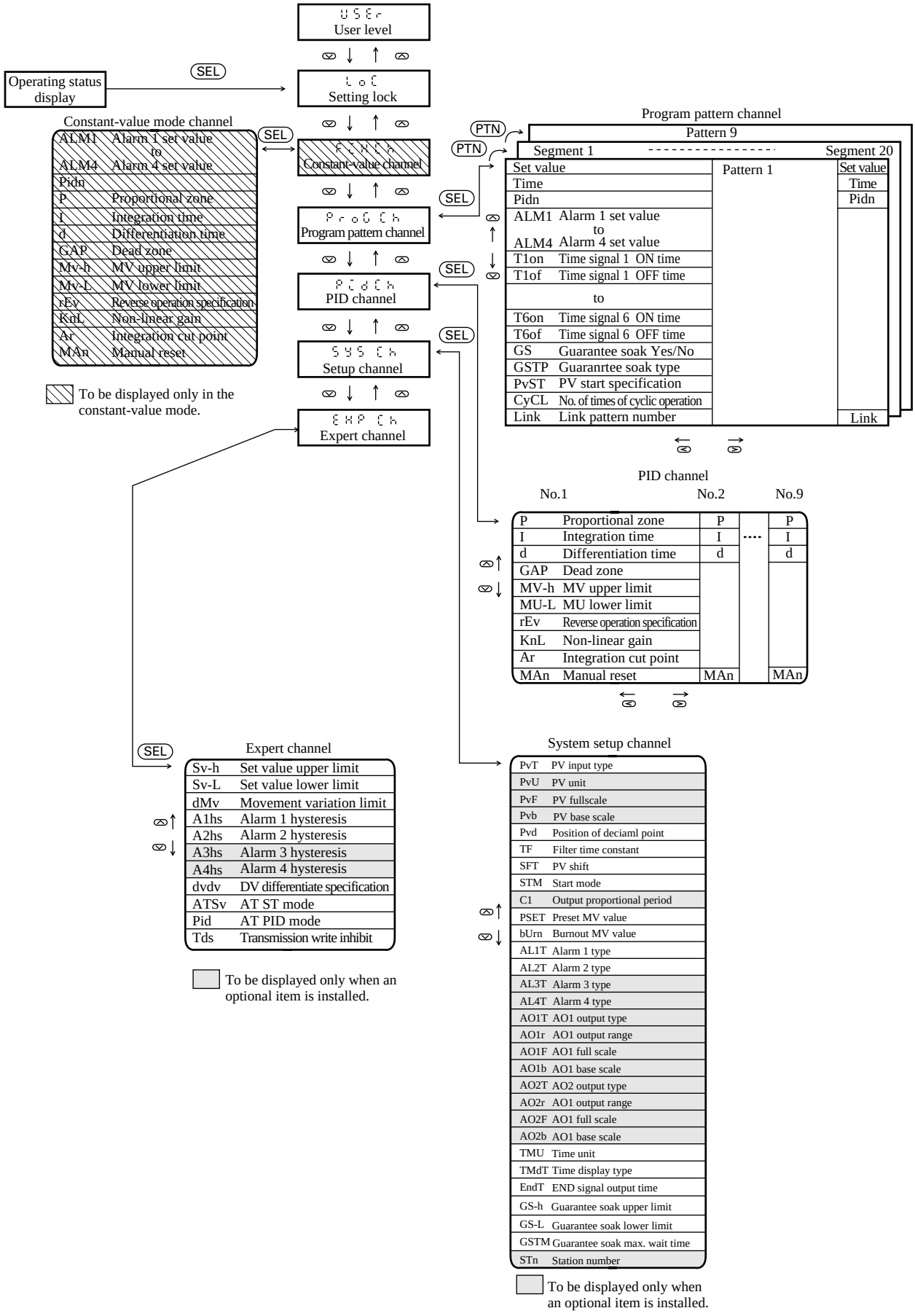


Figure 6-1 Parameter Map

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